MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 37 · FEBRUARY, 1931 Number 6

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Product Index 244-262 Total Distribution for January, 17,034 Copies Advertisers Index 265-266

PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ALEXANDER LUCHARS, President ROBERT B. LUCHARS, Vice-President EDGAR A. BECKER, Treasurer
ERIK OBERG, Editor FRANKLIN D. JONES, Associate Editor CHARLES O. HERB, Assistant Editor FREEMAN C. DUSTON, Assistant Editor
LONDON: 52 Chancery Lane PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received fifteen days before they are to be made on our mailing list. Please send old, as well as new, address.

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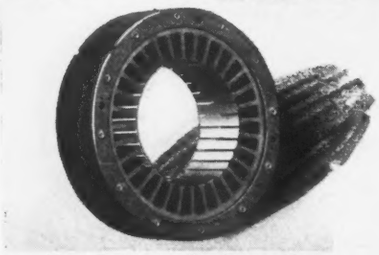

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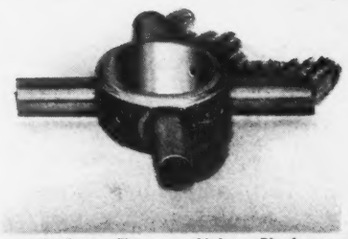

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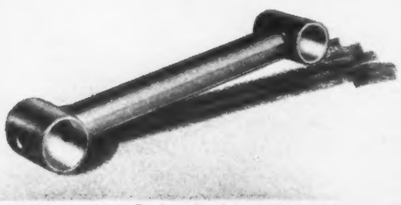

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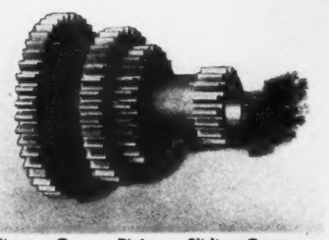

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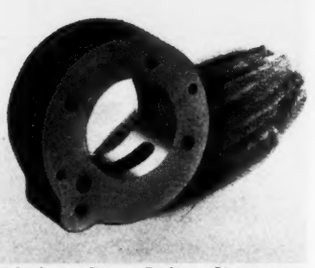

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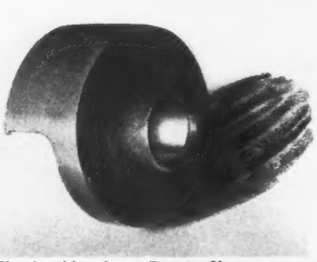

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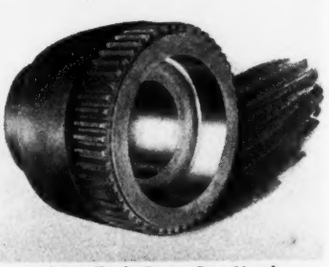

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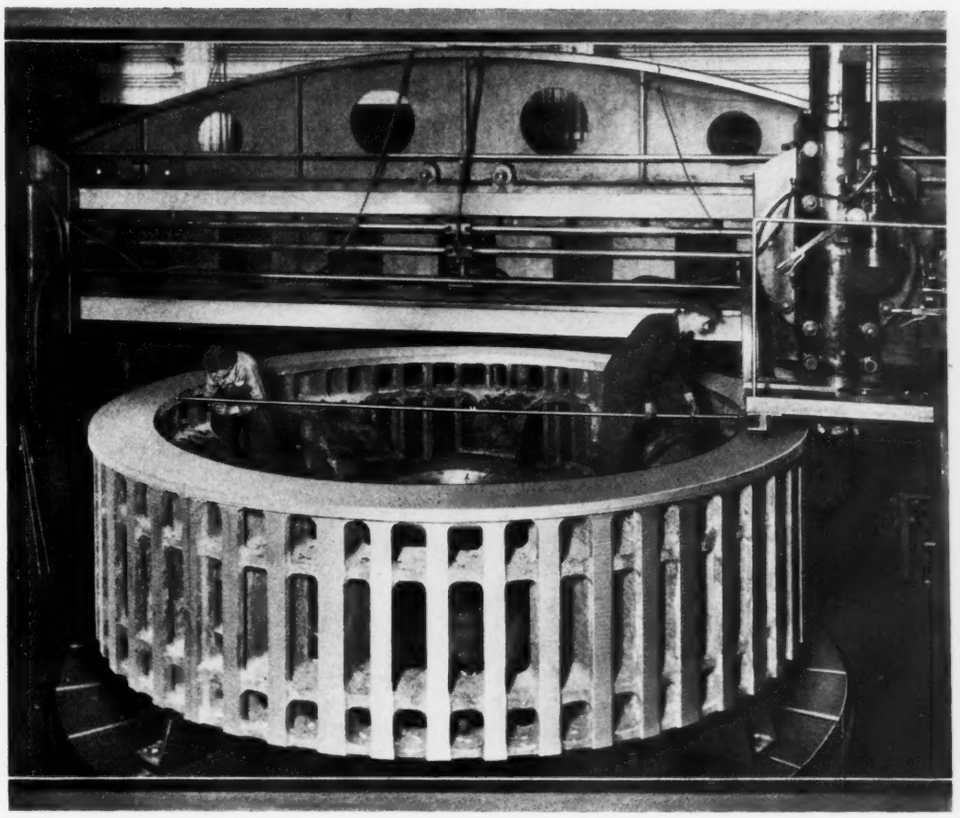


How Would You Gage 40-foot Work?

By CHARLES O. HERB

SUPPOSE you were given the job of gaging the dimensions of a rotor for a huge hydro-electric unit that had to be machined to size within limits of a few thousandths of an inch, how would you solve the problem? Almost everyone is familiar with the conventional methods of inspecting parts measured in inches, but comparatively few are acquainted with the means employed for gaging parts 20 to 40 feet in diameter. This article will describe some of the practices followed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in gaging large parts that must be finished to within tolerances of 0.005 or 0.006 inch of the specified dimensions for the work.

Long tubular pin gages equipped with a fixed point at one end and an adjustable point at the other, are used for inspecting the diameter of internal surfaces. Such an inspection is shown in the heading illustration being performed on a rotor for a large water-wheel generator unit. The adjustable points of these pin gages are set accurately in the tool-room by the use of measuring machines, end measuring rods, and a rail extension micrometer. They are set for each job and sometimes rechecked before the job is finished.

The rail extension micrometer consists of a graduated steel rail, 36 feet long, which is equipped with a fixed head at one end and an adjustable microm-

eter head at the other end. With this device, accurate lengths can be conveniently obtained between the micrometer spindle and the anvil of the fixed head to meet requirements. As may be seen in Fig. 5, the rail is mounted on screw jacks so that it can be kept level. End measuring rods are used, as illustrated in Fig. 4, for setting the micrometer spindle the required distance from the anvil of the fixed head, in even feet and inches. Then, after the micrometer head has been clamped to the rail by the bottom lever, the micrometer spindle is employed to obtain settings in thousandths of an inch. Long end measuring rods are supported on stands positioned along the extension rail, and short measuring rods are held on rests mounted on the rail as illustrated.

Before any gage is set, it is permitted to lie in the tool-room for several hours to insure that its temperature is the same as that of the room. Otherwise, errors in the gage length would occur as the gage expanded or contracted when its temperature changed. In making a setting, the pin gage is supported at several points along its length in the manner shown in Fig. 5. The supports are equipped with accurate rollers arranged in the form of a vee. The locations of the supports are carefully marked on the gage with tape, and when the gage is used in the shop later, the inspectors must support it at the same points; otherwise sagging of the rod might occur, and this would cause serious discrepancies. For example, the sag of a 197-inch gage amounts to as much as 1/2 inch. A tag is attached to the gage to tell which side of the rod was held uppermost while the setting was made, and the same side must be held upward when the gage is being used.

Pin gages over 25 feet in length are fitted with a spider at the middle from which wires under tension extend to the ends so as to lessen the tendency of the gage to sag when held horizontally. The gage being set in Fig. 5 is of this type. These pin gages are of tubular construction, which gives light weight with maximum rigidity. Practically all gages used for this large work are adjustable, so that they can be applied on more than one job.

At *A* in Fig. 6 may be seen the adjustable end of a typical pin gage. It consists merely of a tapered point having a screw that engages a tapped hole in a plug inserted in the gage handle. A knurled head facilitates moving the screw in or out, and there is a headless set-screw for locking the adjustment.

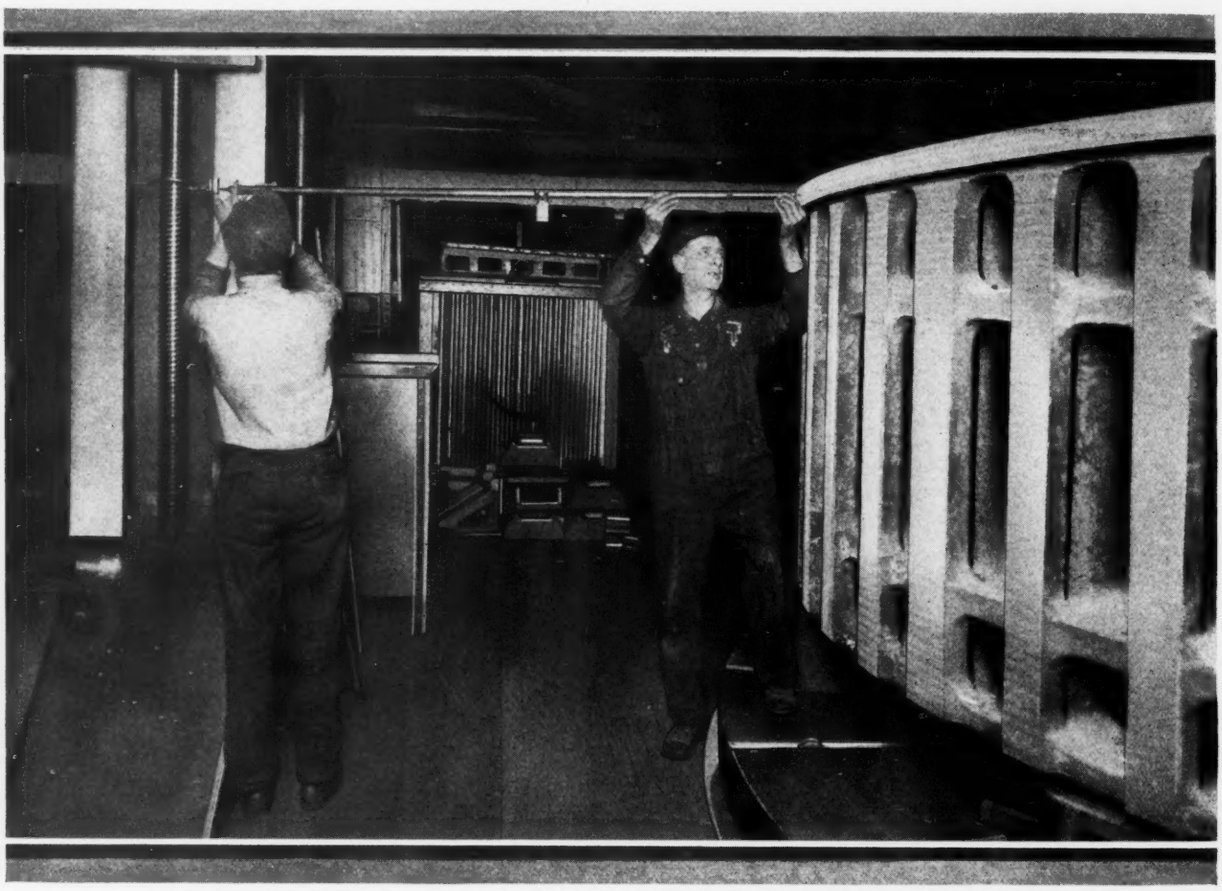


Fig. 1. The Outside Diameter of Large Work on Boring Mills is Measured by Applying Accurately Set Pin Gages Between the Work Surface and a Micrometer Attached to the Column of the Machine

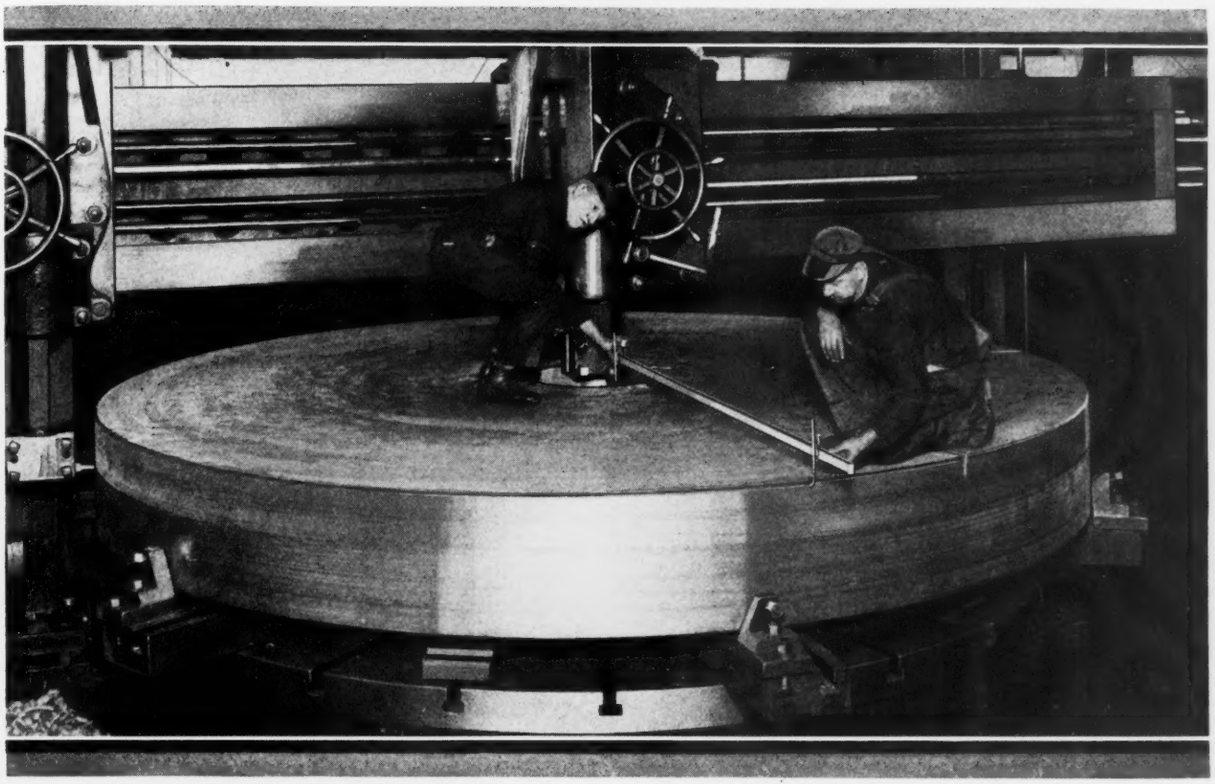
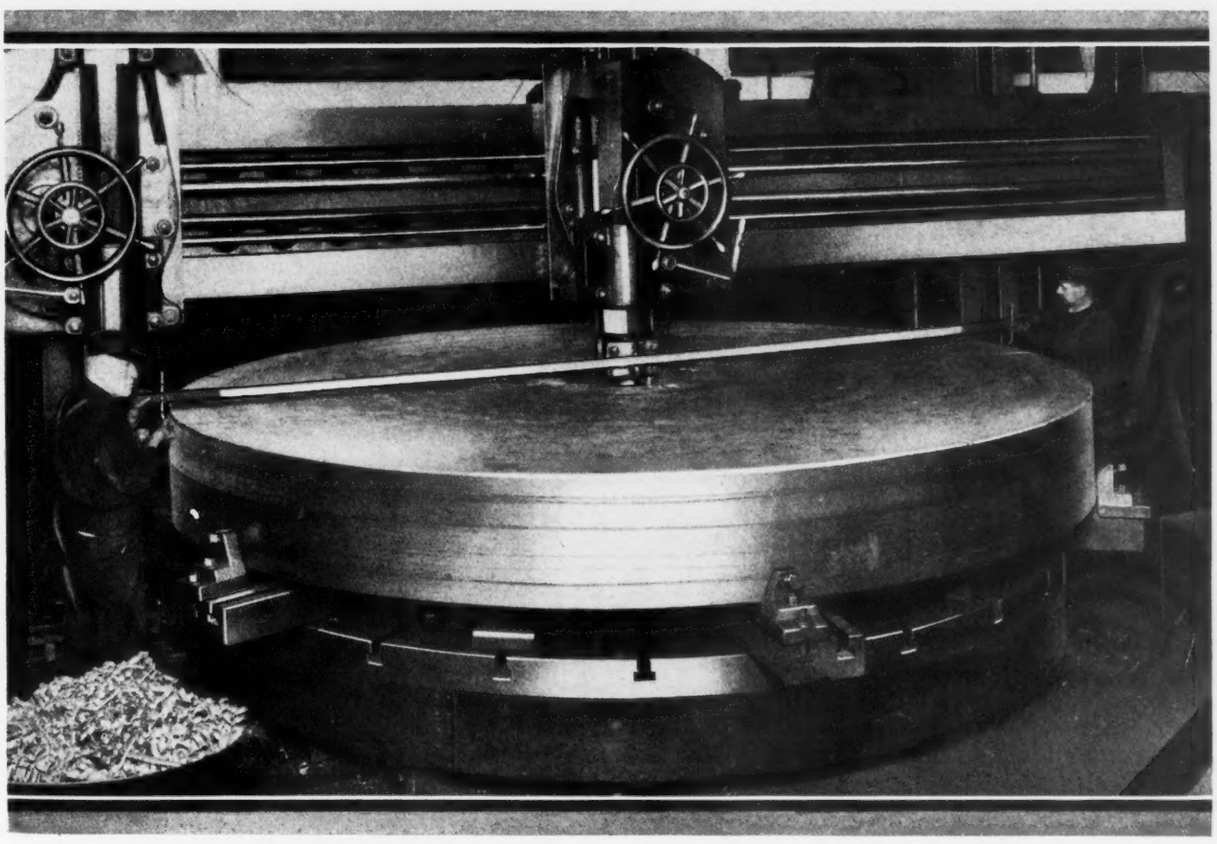


Fig. 2. The Use of a Tram Bar with Calipers Provides a Convenient Method of Determining the Diameter of Work that Has a Finished Bore

Fig. 3. This Method of Gaging Diameters May Also be Used as Indicated Below for Measuring Work When the Bore has not been Finished



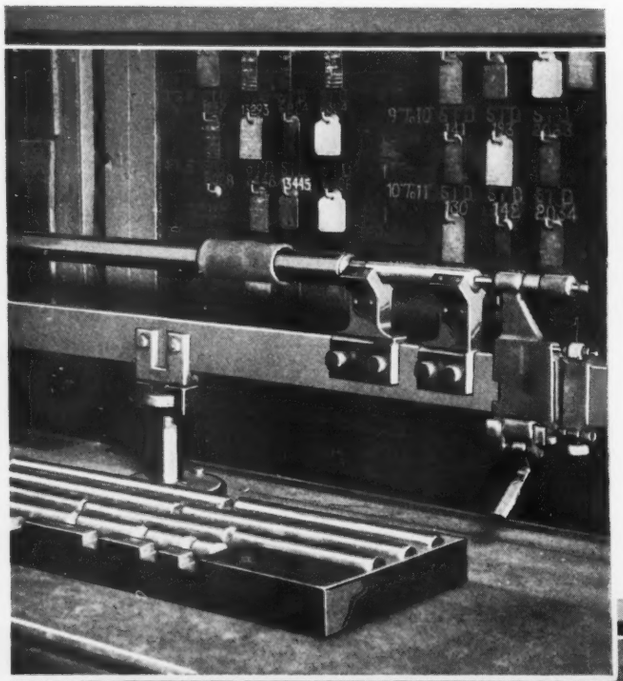


Fig. 4. The Micrometer Head is Located Approximately on the Rail Extension by the Use of End Measuring Rods, and then Precise Measurements are Obtained by Adjusting the Micrometer Spindle

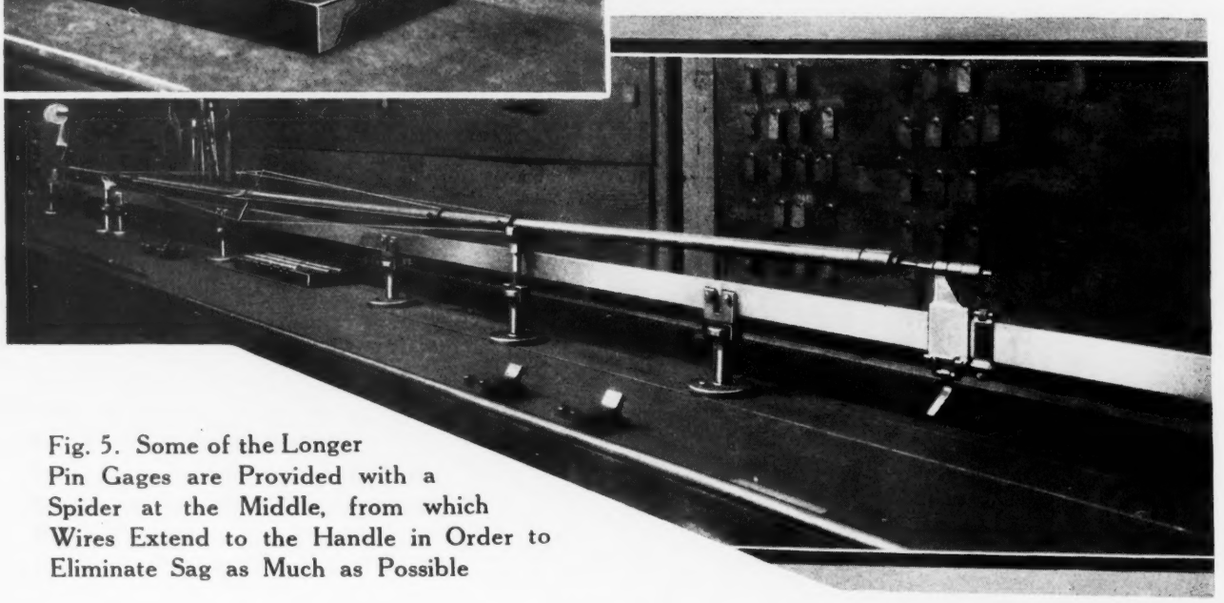


Fig. 5. Some of the Longer Pin Gages are Provided with a Spider at the Middle, from which Wires Extend to the Handle in Order to Eliminate Sag as Much as Possible

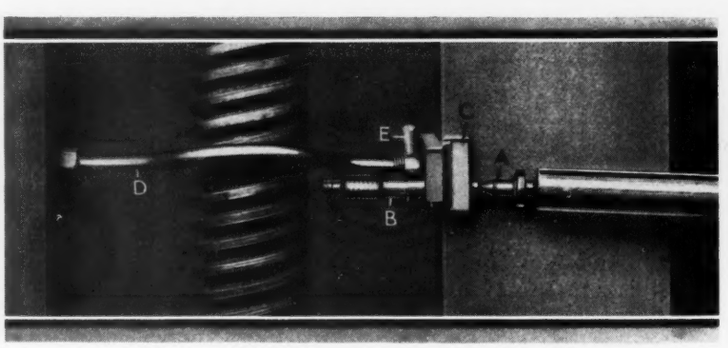
Pin gages are also used for measuring the outside diameter of large parts, as will be apparent from Fig. 1, which is another view of the machine and work shown in the heading illustration. In such an inspection, the pin gage is used in conjunction with a micrometer which is attached to the machine column, as shown at *B* in Fig. 6.

By knowing the distance from the center of the machine table to the column, and thus to the micrometer spindle, the gage setter can readily calculate the required length of the pin gage for checking any outside diameter. On the particular machine illustrated, the distance from the center of the table to the end of the micrometer spindle with the spindle set at 0.500 inch, is 176.922 inches. This measurement is marked on a plate fastened to the column.

Straightness of turned surfaces is determined by moving the micrometer attachment up and down the column and applying the pin gage at different heights. Out-of-roundness is detected by gaging at various points around the circumference of the work.

The micrometer *B*, Fig. 6, is fastened to a block *C* attached to the curved rod *D*. Block *C* bears against the inside of one way of the machine column, while a nut on the opposite end of rod *D* bears against the inside of the other way. By loosening clamp *E*, the device can be moved to any height, and it can be locked by retightening the clamp. The spindle

Fig. 6. Micrometer Attachment Applied to Boring Mill Upright for Gaging Work as Shown in Fig. 1



of the micrometer obviously projects through a hole in block *C*.

External diameters up to 6 feet are measured by big C-type micrometers and gages, the spindles of which are set and locked in the tool-room. These gaging devices can be applied along the sides of the work, with the contour of the piece being inspected extending into the bow of the gage.

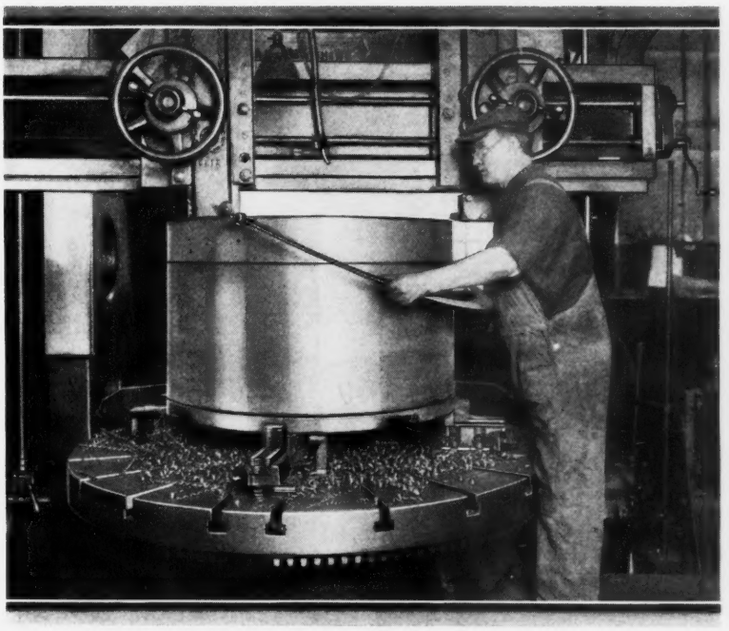


Fig. 7. C-type Gages can be Applied with the Contour of the Work Extending into the Bow of the Handle

Figs. 7 and 8 show applications of these types of gages. In Fig. 7, the gage has one fixed end and an end with an adjustable point of the same kind as is provided on the tubular pin gages. The work in this illustration is a stator, 43 1/2 inches in diameter, which must be true to size within from 0.002 to 0.004 inch.

The gage used in Fig. 8 has a standard micrometer at one end and a fixed anvil at the other end. It is used for taking measurements along a heavy shaft averaging 30 inches in diameter. The over-all length of the shaft is about 34 1/2 feet, and the weight approximately 91,600 pounds, one of the largest shafts ever made.

For inspecting surfaces over 6 feet in diameter, beam-type devices are used to a large extent, as well as the method illustrated in Fig. 1. These gaging devices consist of a long tube with adjustable brackets mounted at the ends. On one of the brackets there is a micrometer unit, and on the other, a fixed contact point. The brackets and the spindle of the micrometer are accurately spaced by means of end measuring rods in the tool-room, and are locked in place.

Beam-type gages are obviously applied across the ends of work, rather than along the sides. They are especially convenient for measuring turned surfaces inside a casting or a built-up welded part that could not be inspected by the method shown in

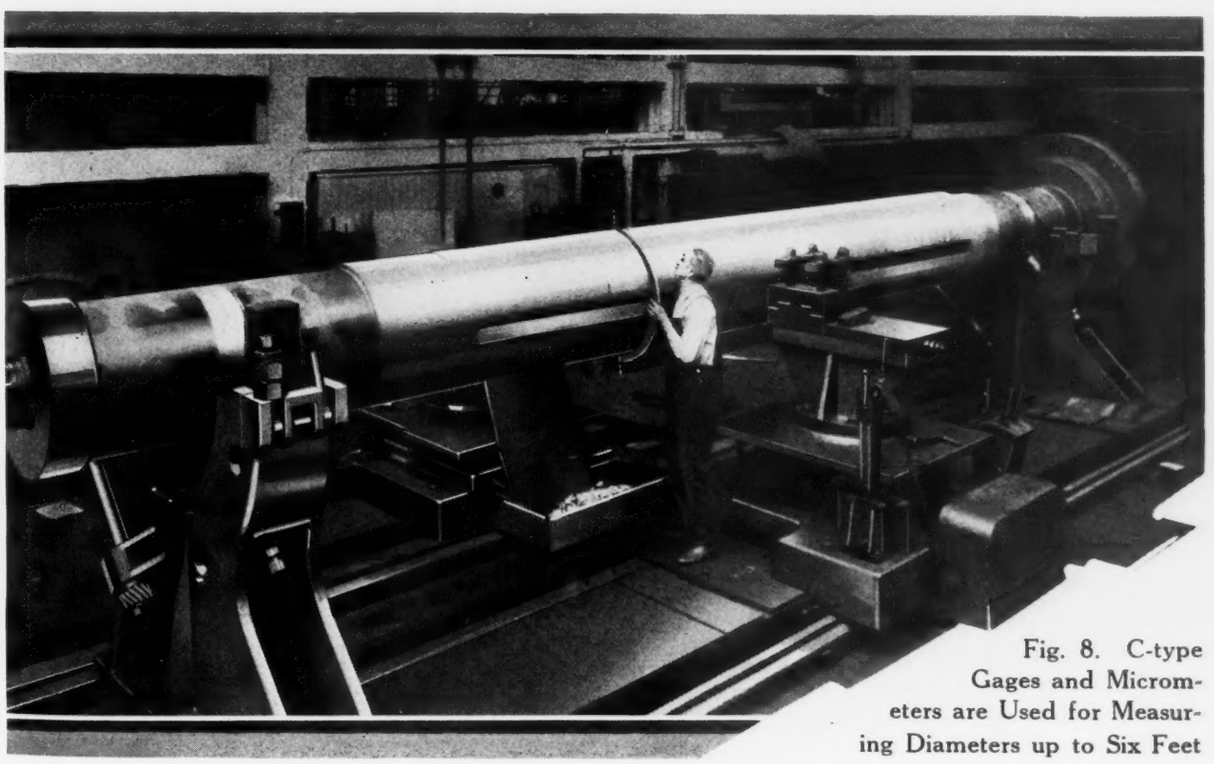


Fig. 8. C-type Gages and Micrometers are Used for Measuring Diameters up to Six Feet

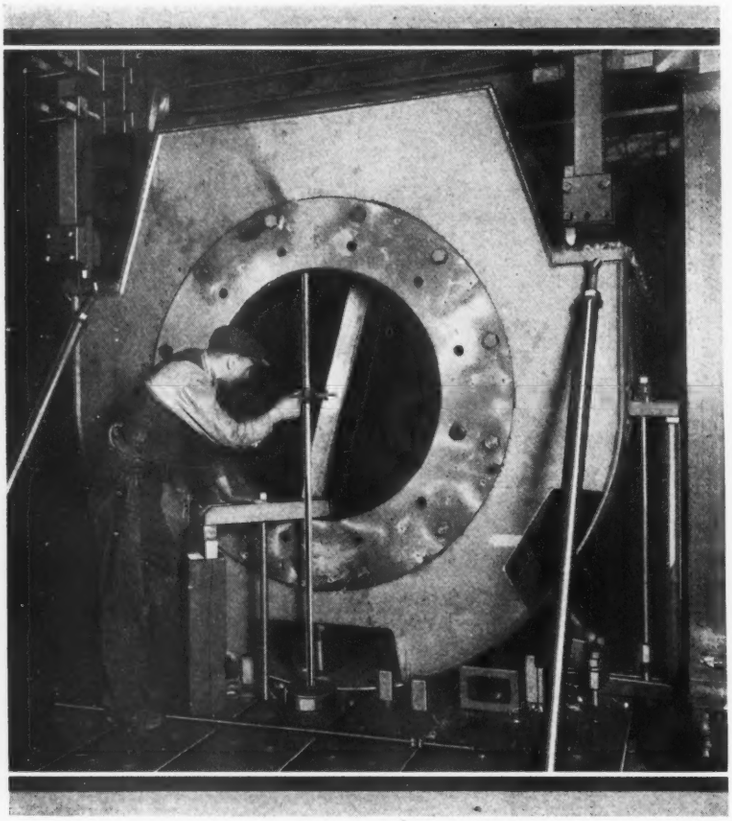


Fig. 9. After the Height of the Work Center above the Planer Table has been Determined as Shown, the Tool Settings can be Easily Calculated

Fig. 1, because of interference from an outer wall.

On certain jobs, long tram bars with calipers are used as illustrated in Figs. 2 and 3. These calipers are also positioned to within 0,001 inch by the use of end measuring rods and the rail micrometer. The work shown in these illustrations is a flywheel 15 feet in diameter, weighing approximately 140,000 pounds, or 70 tons. It is intended for use on a large motor-generator set. This huge mass of steel will be revolved at a speed of 300 revolutions per minute. The rated capacity of the unit for which it is intended is 6000 kilowatts. This flywheel is constructed from five disks of steel which are welded together to a thickness of 19 1/2 inches.

When the bore of such work has been finished to size, the distance from the bore to the circumference is measured as illustrated in Fig. 2. Obviously, this dimension doubled and added to the bore diameter, gives the outside diameter. However, if the bore has not previously been machined, the method shown in Fig. 3 must be employed for inspecting the outside diameter.

Fig. 9 shows the means employed for determining the distance from the table of a planer to the center of large work. The particular job illustrated is a turbine generator frame, constructed of steel plates welded together. A timber has been driven into place across the bore and the center marked on it. The operator is shown transferring the location of this center to a height gage. He will then employ a 6-foot steel scale to find the distance from the pointer of the height gage to the bottom of its base. Knowing this height, the operator can determine the required distance from the table to the tools on the rail heads for planing the various surfaces of the work.

Pin gages, adjusted to suit the machine set-up as determined in the manner just described, are supplied to the operator for inspecting finished surfaces. Fig. 10 illustrates such an inspection.

On work of this nature, pin gages are also used for measuring the distance between inside vertical surfaces, while tram devices, similar to those illustrated in Figs. 2 and 3, are employed for measuring over outside vertical surfaces.

Fig. 10. On Planer Work, the Height from the Table to the Finished Surface is Measured by the Use of Pin Gages and Straightedges

Some Experiences with Tungsten-Carbide Tools

By KARL F. SMITH, Commander U. S. Navy
Assembly and Repair Officer
San Diego Naval Air Base

THE experiences with tungsten-carbide tools in the shops of the Naval Air Station at San Diego, California, have been very interesting, and a few jobs are described in the following article that will probably be of interest to industry at large.

The truing-up of grooves in aluminum alloy aircraft pistons is about as difficult a job as anyone would wish to undertake. The cuts, even with the most carefully designed and ground tools, are rough, because the metal tears, and the finish is poor unless extreme care is taken. These aluminum alloys turn or dull the edge of the best high-speed steel tool in a very short time. On reworking pistons for over-size rings, only three grooves could be finished, with the tools used in the past, before the tool required regrinding. As there are four grooves in a piston, it was not possible to complete one piston without regrinding the tool. The time for regrinding and resetting the tool was three and a half minutes.

Through the cooperation of the engineers of one of the companies making tungsten-carbide tools, a special tool with a tungsten-carbide tip was obtained. The result has been an increase per man of from 40 to 180 pistons, and as there are four grooves in each piston, this means that 720 grooves are finished per day. Moreover, this is done without regrinding or lapping the tools.

Again, in machining Kelmet bearings (and certain high-lead bronzes are equally bad) we have had serious tool troubles. The shift to tungsten-carbide tools remedied this difficulty. In reaming bearings of master and articulating rods, the reamers used in the past would dull after completing about three rods, and the production was limited to 20 rods per day per man. Fly cutters made from special cutting alloys were tried, with some improvement in time.

Then a special, fully universal machine was designed with air-cooled micrometer boring heads provided with tungsten-carbide cutting edges, and as a result, both ends of the rods are reamed simultaneously with a tolerance of 0.0005 inch on the diameter, and are made accurate for parallelism within 0.001 inch on a 6-inch arm. The machining is done by a combined roughing and finishing cut. The finish is as nearly perfect as could be desired, and the most important point of all is that 190 rods are finished per man each day.

Tungsten-carbide lathe tools are used at the Naval Air Station with equally good results; however, they are not yet generally employed by all the men, but by special mechanics only. Trouble has been encountered with the inserts showing a tendency to break out, but we have been able to sweat them back in place without difficulty. We have not found these tools satisfactory for shapers or planers, nor for any operations subjecting the point to shock. I am informed, however, that tools that are suitable for these machines are now being brought out.

In our experience, tungsten-carbide tools should be ground with less clearance and rake than high-speed steel tools, and we have found that the point should be set at the exact center or slightly above the center when turning. We have also found that the clearance of the tool should be varied according to the material being cut. In our own work, we determine the best clearance by experiments.

The scale on forgings of tungsten-chromium-molybdenum steel, as well as on rough castings, presents no difficulty except when machining a weld; in that case, the feed or depth of cut should be materially reduced on the first cut. On heavy work we have found that, contrary to the general conception, much deeper roughing cuts can be taken than with any other kind of tool. After the roughing cut, the tool is changed and the finish cut for size is taken.

COMMANDER KARL FREDERIC SMITH was born in New York City in 1885. He graduated from Annapolis in 1908. After having been chief engineer on gunboats, cruisers and battleships, he was selected to take a post-graduate course in engineering, upon the completion of which he became attached to the Naval Engineering Experiment Station in 1913. The next year, he took further post-graduate work at the Columbia School of Mines, graduating with the degree of Master of Science. After having been chief engineer of several large ships in the Navy, he became fleet engineer of the Asiatic Fleet and Stations, and later inspector of engineering materials, with headquarters at Cincinnati, Ohio. On the formation of the Bureau of Aeronautics, he became general inspector of aeronautics and liaison officer with the Army Engineering Division at McCook Field; still later he served as assembly and repair officer at the Naval Air Station at San Diego, Calif., where the largest shops in the world confined to repair work are maintained.

We are now experimenting with feeds and speeds, but have not yet found the limits. We have stalled 15-inch lathes, with the lubricating oil flashing on the tool point, without any damage to the tool.

We are also using sand-blast nozzles with tungsten-carbide inserts. These nozzles cost $30 apiece, as against 18 cents apiece for cast manganese-steel nozzles, but the life of the tungsten-carbide nozzles is over eighteen hundred hours at 25 pounds blast pressure, as against three hours for the ordinary nozzle. The economy, however, arises largely from the lower power consumption, because by reducing the nozzle wear, there is less air consumption. We operate these nozzles eight hours a day, using fourteen nozzles at pressures varying from 15 to 75 pounds, with sharp silica sand and steel shot. Anyone using sand-blast nozzles will find it worth while to try tungsten-carbide inserts in these nozzles.

How One Machine Tool Builder Handles Inquiries

The importance of handling customers' inquiries promptly is so thoroughly recognized by one machine tool builder that the whole system of handling inquiries and submitting bids has been organized with a view to obtaining prompt action.

Immediately upon receiving the morning's mail, the sales department turns over all mail containing inquiries to the tool engineering department. A slip is attached to each letter specifying the date when the letter was received, the name and address of the firm making the inquiry, the number of blueprints or samples attached, and a request to furnish any or all of the following information: Machine recommended, production estimate, tool cost, and date of tool delivery. A copy of this slip is retained by the sales department as a reminder, so that if the report from the tool engineering department does not come back within a reasonable length of time, an inquiry may be made as to the cause of the delay.

When the tool engineering department receives the inquiries, they are immediately turned over to an estimator who decides upon the method of performing the work, makes out the detailed tool estimate with cost, and prepares a production estimate, giving floor-to-floor time. Special forms are provided for these estimates. As soon as completed, they are immediately photostated, after which the production estimate is pasted to the customer's original blueprints, so that the blueprints and the production estimate will always go together. The tool engineering department checker then reviews the estimate to be sure that everything is correct, after which the customer's letter, the original blueprints, and the production and cost estimates are returned to the sales department for immediate action.

Each production estimate is numbered and is always referred to by that number; and the folder in which all of the mail relating to any one cost and production estimate is kept is provided with the same number. An index is also provided, giving the name of the firm from which the inquiry was received and the number of the folder in which the information pertaining to it is kept.

By this method it has been found possible to reply to an inquiry the day after it is received, with all the details required worked out.

What is Nitriding and How is it Done?

Much has been written on the subject of nitriding during the last two years; yet it is surprising to find how few of the men responsible for the quality and quantity of the output of a shop thoroughly understand this process and its possibilities. The leading article in March MACHINERY has been written with a view to answering authoritatively the question "What is nitriding, and how is it done?" J. H. Cates, Jr., an engineer with the General Electric Co., will outline in this article the results obtained with the nitriding process, and describe the equipment employed in its application. The article is brief and to the point; yet it covers every phase of the subject fully.

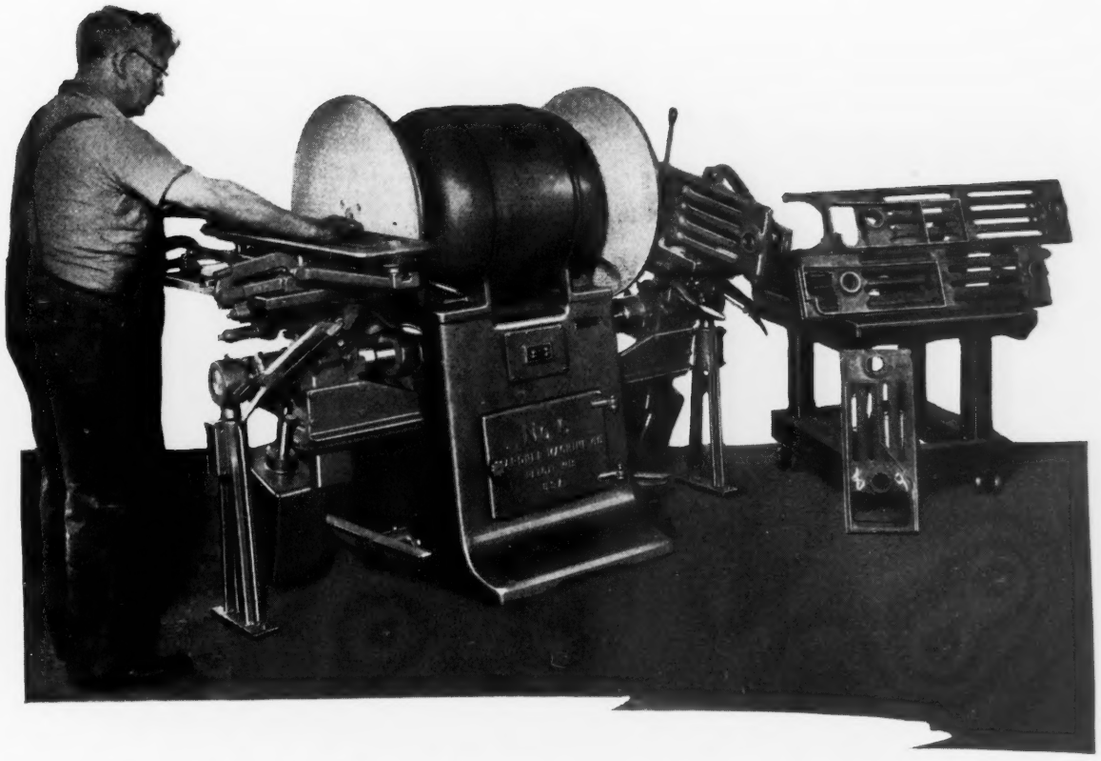
* * *

The directors of the National Automobile Chamber of Commerce, at a recent meeting, unanimously recommended that the industry should announce its new models, hereafter, in November or December each year. In this way it is expected that a substantial part of the expense incident to tooling up new models will be eliminated, as there will be less disorganization of manufacturing schedules at this time of the year. Tooling up for new models in the spring or summer season, when manufacturing schedules reach a maximum, is always very costly.

The employment situation in the automobile industry will also be substantially improved, because production generally falls off in November and December; hence, the bringing out of new models and the stocking up of the dealers at that time will materially help to even up production throughout the year and insure steady employment during the winter months.

* * *

The wholesale value of the automobile industry in the United States in 1930, including passenger cars and trucks, amounted to $2,159,600,000. The average retail price of passenger cars was $800, and of trucks, $922. The total number of cars and trucks built during the year was 3,505,000, of which 2,943,000 were passenger cars and 562,000 trucks.



Special Equipment for Grinding Flat Surfaces

Rapid Advances Have Been Made in the Application of Work-holding and Feeding Means to Disk and Ring-wheel Grinders

THE history of the metal-working industry is a record of continuous progress in the construction not only of the machines, but of the tools as well. For example, tools made of a high-speed steel can now be obtained for cutting manganese steel, and cutters with tungsten-carbide inserts are daily breaking production records.

Similar advances have been made in the process generally known as "disk grinding." When the first disk grinder was built in 1890, the abrasive member consisted of a thin, paper-backed emery disk with fine grains. It was soon found that the possibilities of the new type of machine were decidedly limited by this abrasive member, and so disks two or three grains in thickness, backed by cloth, were developed.

Years later, disks were made 1/4 inch thick, and then 3/8 and 1/2 inch thick. Now, abrasive members for machines of this type are obtainable as thick as 1 and 2 inches, and they can no longer be considered "grinding disks" in the old sense. Moreover, abrasive members have been produced for finishing such materials as hard rubber, bakelite, firebrick, and asbestos compositions, in addition to all kinds of metals. Different abrasive members are usually recommended for grinding wet or dry.

These improvements in the abrasive members have enabled advances to be made in the machines themselves leading to increased production rates and reduced costs. Machines designed by the Gardner Machine Co., Beloit, Wis., specifically for grinding flat surfaces on a production basis will be described in this and succeeding articles.

Swivel Type Fixtures Facilitate the Handling of Heavy Parts

The heading illustration shows a machine arranged for grinding the sides of radiator sections of various types and sizes. The majority of these sections are approximately 33 inches long by 8 1/2 inches wide, and must be ground parallel within 0.008 inch. In each case, the surfaces ground consist of narrow, ribbon-like shoulders, about 1/4 inch wide, that form different outlines on the sides of the sections. About 3/32 inch of stock is removed from a side.

The important feature of this equipment is the construction of the fixtures. While reloading, the fixtures are in a horizontal position, as illustrated in Fig. 1, and they are swung into a vertical position, parallel with the abrasive members, as shown in Fig. 2, for the grinding operation. This arrangement enables heavy sections to be loaded far

more easily than if the fixtures were in a vertical position. One side of the sections is ground in one fixture, and then the work is placed in the opposite fixture and the other side is ground parallel with the first. The tables are of the mechanically oscillated type.

How the Sections are Located in the Fixtures

When the radiator sections reach the grinding machine, the holes near the ends have been taper-reamed and the bosses surrounding these holes have been spot-faced. The surfaces to be ground

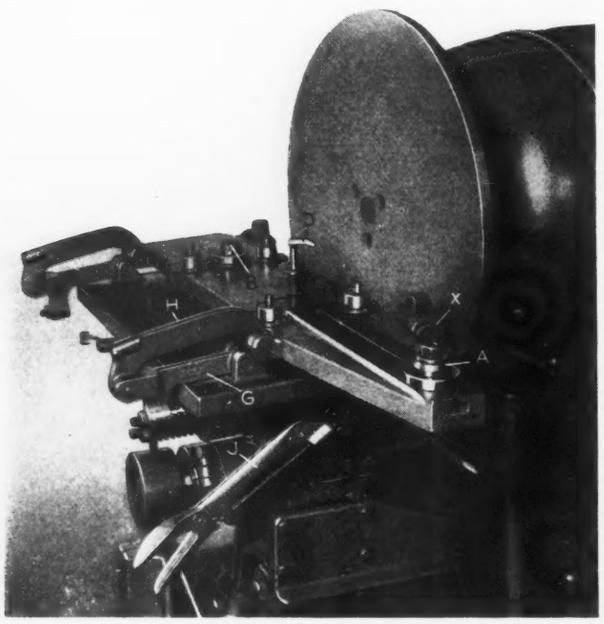


Fig. 1. Grinding Fixture which Facilitates Handling Heavy Castings. Note Horizontal Position of Fixture for Loading

must be finished at right angles to the center lines of these holes; hence locating plugs *A* and *B*, Fig. 1, are provided to fit these holes, and the spot-faced surfaces of the sections rest on the collars that surround the plugs. It will be noted that plug *A* is adjustable along the fixture to accommodate work of various lengths.

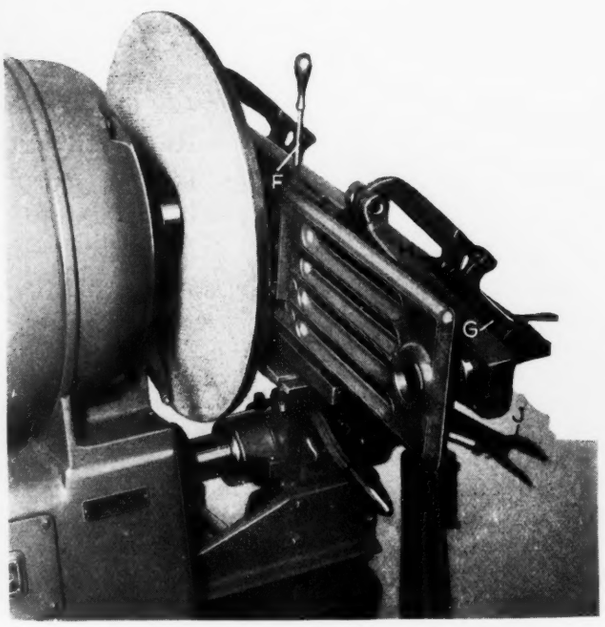
In the fixture employed for the first operation, there are four self-locking pins *C*, which provide added support for the castings. These pins are free while the fixture is in the loading position, but are locked automatically against the work before the grinding position is reached. The fixture used for the second operation differs somewhat in that fixed plates are provided for locating the work by means of the surfaces ground in the first operation.

After a section has been seated in the manner explained, with hook *D* extending through one of the lengthwise openings, the hook is swiveled 90 degrees to bring it across the aperture. Then handle *E* is moved to pull the hook firmly down on the work, and handle *F*, Fig. 2, is raised to lift the fixture and work into a vertical position parallel with the abrasive member. (At the time that the photograph reproduced in Fig. 1 was taken, the handle that is used for lifting the fixture had been removed.)

Raising of the fixtures is facilitated by counterweights. As either fixture is lifted, it swings on two trunnions *X*, Fig. 1. Links *G* and *H* swing upward and position themselves in such a manner as to force the work against the grinding disk with a pressure of 600 pounds. Lever *J*, Figs. 1 and 2, is standard equipment ordinarily used to release a spring for forcing the work against the abrasive member.

With this equipment, one operator grinds 30 sections per hour on both sides, loading one fixture while work in the opposite fixture is being ground. The abrasive members are disks 26 inches in diameter by 1/2 inch thick.

Fig. 2. Vertical Operating Position of Grinding Fixture. The Sides of the Casting are Held Parallel with the Grinding Disk



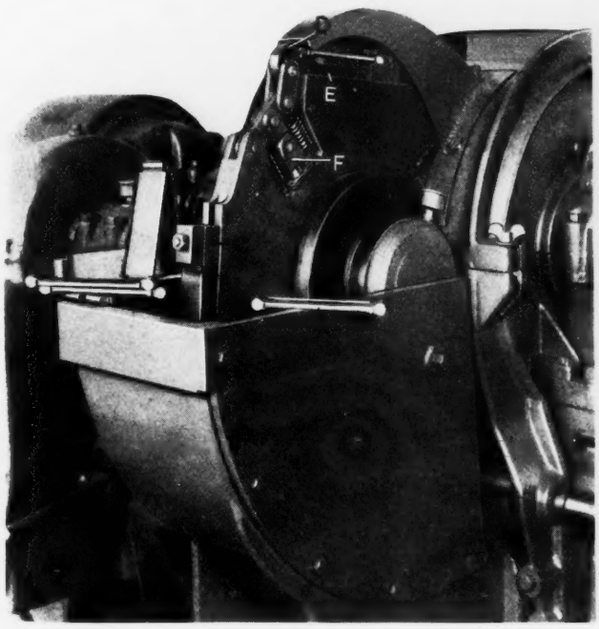
Two double-spindle machines of the general construction shown in Fig. 5 were built for grinding both sides of automobile hinges simultaneously. Fig. 3 illustrates the work-carrier provided on the machine designed for handling the male part *A* of these hinges, while Fig. 4 shows the carrier furnished on the machine that handles the female part *B*. Part *A* is split in two after grinding. Both parts are made of hot-rolled steel. They are ground to within plus or minus 0.005 inch of the specified width and within 0.004 inch of parallelism. The

stock removed in these operations does not exceed 0.060 inch over all.

The production of part *A* averages 16 pieces per minute and of part *B* 20 pieces per minute, or 960 and 1200 pieces per hour, respectively. Abrasive members 3/8 inch thick and 23 inches in diameter are employed on both machines. There is no movement of the grinding heads in and out, and so the parts are ground with a shear, or "taper" cut.

The main feature of both machines is the construction of the work-carriers. From Fig. 3, it will be seen that part *A* has bosses at the ends somewhat narrower than the surfaces to be ground, these bosses having been milled previously. They form convenient surfaces from which to locate the pieces accurately in the four stations of the carrier. Each of these stations is provided with a support *C* which is adjustable to suit hinges ranging in length from 6 to 9 inches between the boss centers.

Fig. 3. A Rotary Work-carrier Equipped with Automatic Means for Clamping Automobile Hinge Parts as They are Fed to the Grinding Members



Each support *C* consists of a bottom block, slotted to suit the width of the bosses, and a top block having a projecting ledge that holds one boss of the hinge down. At the opposite side of the station there is a hinged hook *D* which is used to clamp the other boss in a slot in block *E*. Hook *D* is clamped and released through the action of plunger *F* and the linkage that connects it to the hook, one end of the plunger riding on a stationary plate cam located on the shaft of the carrier. Although the work pieces are loaded manually, they are discharged by gravity, sliding down the chute seen at the front of the machine in Fig. 5.

Part *B*, Fig. 4, is located approximately for grinding by block *C* on each of the five stations provided on the carrier. Block *C* has a lug that extends into the recess at one end of the work pieces. The opposite end of each hinge is held in a vee formed by block *D* and a spring-backed piece *E*. This piece forces the flat end of the work firmly against clamp *F*, both before and during the clamping. Clamps *F* are actuated in the same way as the clamps of the carrier shown in Fig. 3.

During the time that the clamps have only a partial grip on the hinge, the latter is centered accurately in its station by two guide plates at the top of the machine, one of which is seen at *G*. These guide plates extend to the abrasive members, the full gripping action being obtained before the part reaches the grinding point. It will be seen that block *D* is adjustable to suit hinges from 2 1/4 to 6 inches long from the flat end to the center of the bosses. These hinge parts are discharged from the machine through a chute at the front.

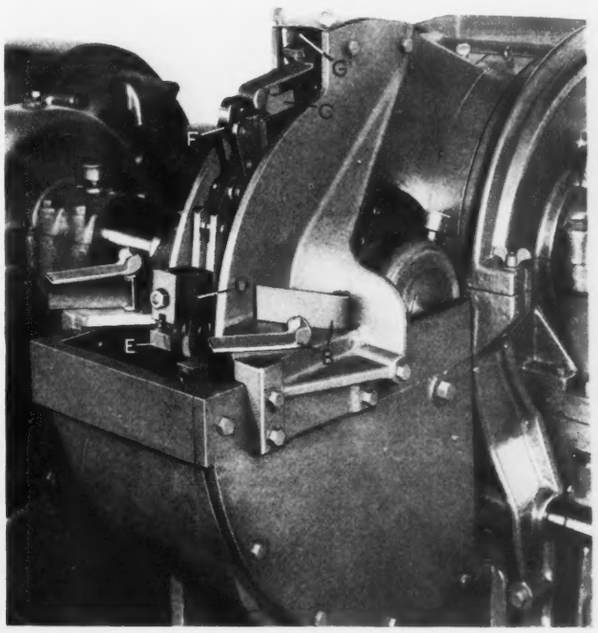


Fig. 4. Two Guide Bars on This Work-carrier Insure Accurate Sidewise Location of the Work Pieces as They Approach the Grinding Members

Another Rotary Carrier Used in Grinding Valve Tappet Guides

A machine of the same type as that illustrated in Fig. 5 has been provided with the carrier shown in Fig. 6 for grinding valve tappet guides. As illustrated, the carrier is set up for grinding the top and bottom of these castings simultaneously. By making slight changes in the set-up, the same carrier can be employed for grinding the two sides.

In both cases, about 1/16 inch of stock is removed, the surfaces being held parallel within 0.005 inch and to a true right angle within a corresponding degree of accuracy. The production is from 4 to 5 pieces per minute, or approximately 270 per hour.

In both operations, the pieces are placed in the different stations of the carrier between the guide plates *A* and *B* which extend to the abrasive members. However, before the work pieces reach the latter, they are securely gripped at each end by clamps *C* and *D*, which are operated through plungers and a plate cam, as in the preceding examples.

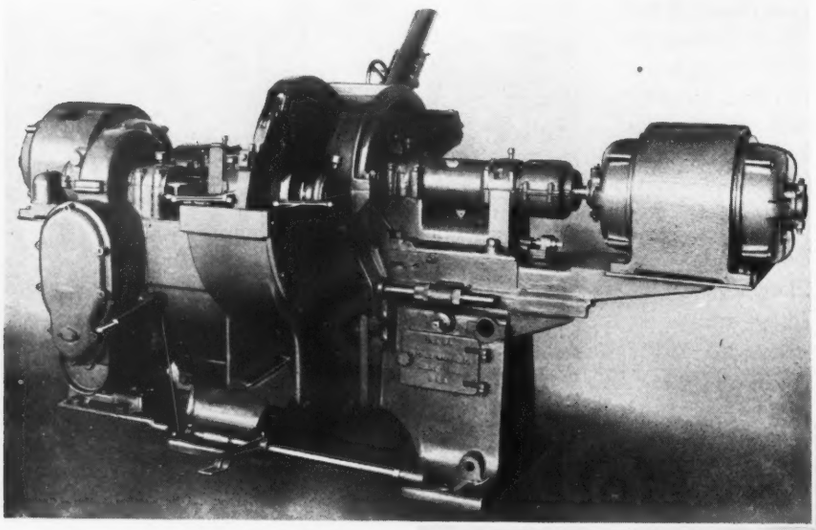


Fig. 5. Two-spindle Grinding Machine Arranged for Finishing Both Sides of Automobile Hinges Simultaneously at the Rate of Almost One Thousand per Hour

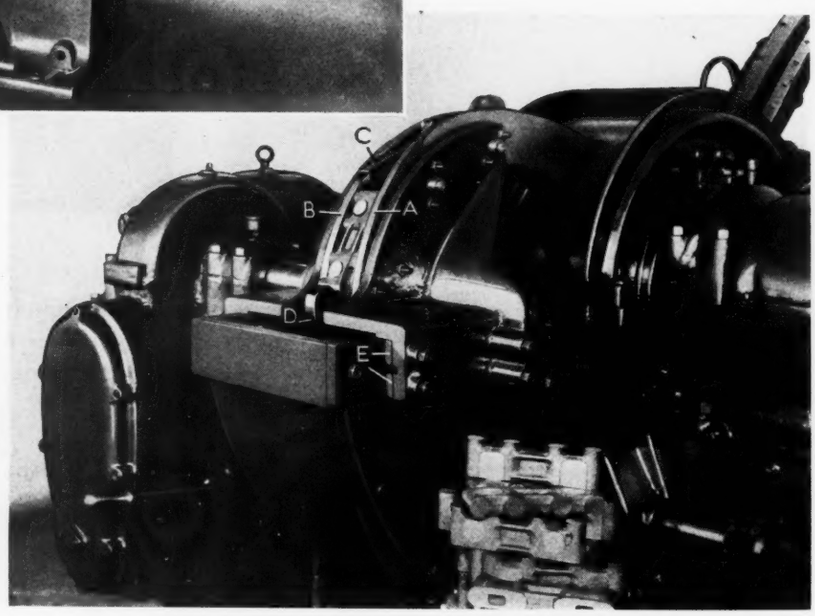


Fig. 6. Work-carrier which is Conveniently Adjustable to Permit Two Different Widths to be Ground on the Work in Separate Operations

It is obvious that the distance across the sides of these valve tappet guides is considerably less than the dimension from top to bottom. When it is desired to grind across the narrow width, the guide plates *A* and *B* are adjusted toward each other the required amount by merely removing filler blocks, such as may be seen at *E*, from between the brackets that support the guide plates and the carrier housing.

Clamps *C* and *D* have vees at their gripping ends to fit the round bosses of the work pieces when grinding the side. The work pieces are automatically released at the bottom of the grinding disks and slide down a chute to the front of the machine, as in the preceding examples. In these operations also, the grinding heads are stationary.

CLOSER SIZING OF ABRASIVE GRAIN

Manufacturers using polishing operations in their production processes will be interested to learn that master samples of aluminous oxide polishing grain will soon be available through the Abrasive Co., Philadelphia, Pa. These samples will help to eliminate the difficulties that have been encountered in the past by both producer and consumer in checking sizes.

In September, 1930, a committee representing the larger artificial grain producers authorized the Abrasive Co., Philadelphia, Pa., to produce master samples for checking all grain sizes, and particularly the new sizes conforming to the General Motors Corporation Specifications. A research fellowship for investigating the subject was established at the Bureau of Standards in Washington for the purpose of analyzing the problems encountered in producing these master samples. A great deal of research work has been done, and many different phases of the problem have been investigated. As a result of these efforts, master samples of polishing grain will shortly be available, after which it will be a simple matter to calibrate sieves. It will also be possible to produce grain to a set standard with such a degree of accuracy that the problem concerning the proper size now confronting the consuming trade will be largely eliminated.

Estimating Time Required for Hobbing Gears

By CLIFFORD CORNWALL

THE time required to hob a gear or stack of gears such as shown in the accompanying illustration depends on the following factors:

1. The approach distance, or the distance A which the hob must feed from the time it starts cutting until it reaches the full cutting depth.
2. The number of teeth N in the gear.
3. The length L of the face of the gear or gears.
4. The number of threads T in the hob.
5. The revolutions per minute S of the hob.
6. The feed F per revolution of the gear blank.

If the hob has a single thread, it must make one revolution for every tooth of the gear being cut, so that for a 50-tooth gear, the hob must make fifty revolutions to one revolution of the gear. If the hob rotates 100 revolutions per minute and feeds 0.050 inch per revolution of the gear blank, then in one minute the hob feeds a distance of 0.100 inch along the face of the gear.

A double-thread hob only makes one-half revolution for each tooth of the gear. Thus, if the hob rotates as before at 100 revolutions per minute with a feed of 0.050 inch per revolution of the gear blank, it will feed a distance of 0.200 inch along the face of the gear in one minute. For example, let the total time, in minutes, required for the hob to travel the distance A plus L be denoted by X. Thus we have,

$$X = \frac{N\,(L + A)}{S \times F \times T} \qquad (1)$$

It will be noted from the illustration that the approach A is equal to half the length of the chord of a circle, the diameter of which is equal to that of the hob being used when the height of the arc subtended by the chord is equal to the depth C of the cut. From the right-angle triangle having sides equal to A, R, and $R - C$ we have,

$$A = \sqrt{R^2 - (R - C)^2} = \sqrt{2RC - C^2}$$

Substituting D for $2R$ in this formula,

$$A = \sqrt{C\,(D - C)} \qquad (2)$$

It is not necessary to feed the hob beyond the point where its center line passes the end of the gear blank, but it might be well to add approximately 0.050 inch in calculating the value A in order to give an even decimal number. As an example, suppose it is necessary to find the time required to hob a stack of five gears, each 2 inches wide, making a total face length of 10 inches. The gears have 36 teeth, are of 6 pitch, and are to be cut with a single-thread hob 4 inches in diameter. The hob is to run at a speed of 90 revolutions per minute and feed at a rate of 0.048 inch per revolution of the gear blank.

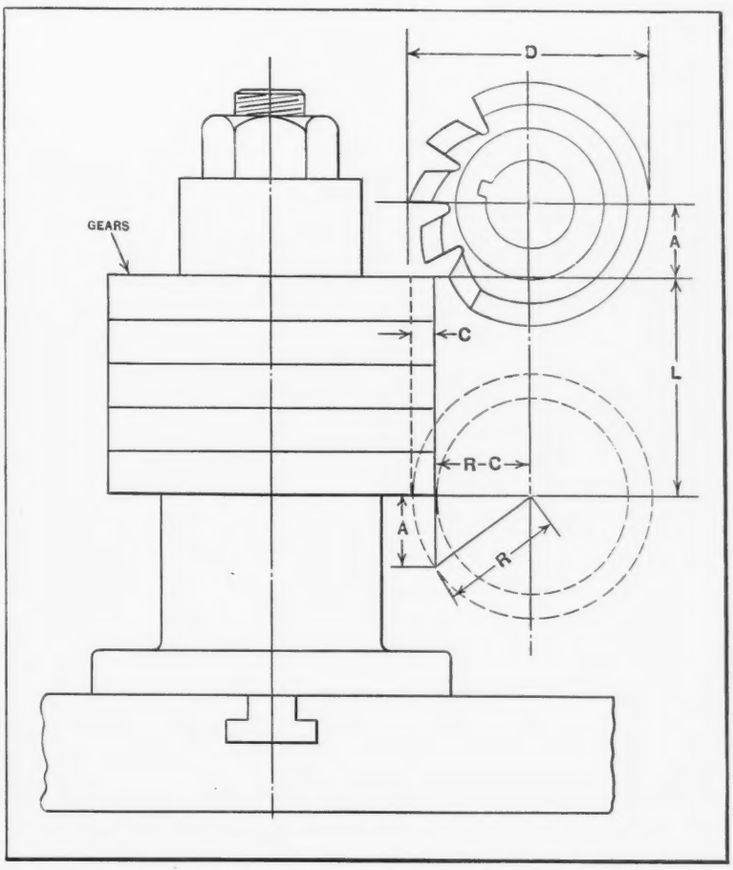


Diagram Used in Calculating Time Required to Hob Gears

Substituting the values given in the foregoing example in Formula (2) for the approach A of the hob,

$$A = \sqrt{0.360 \times 3.64} = 1.144 \text{ inches}$$

Substituting the values in Formula (1) to obtain the elapsed time we have,

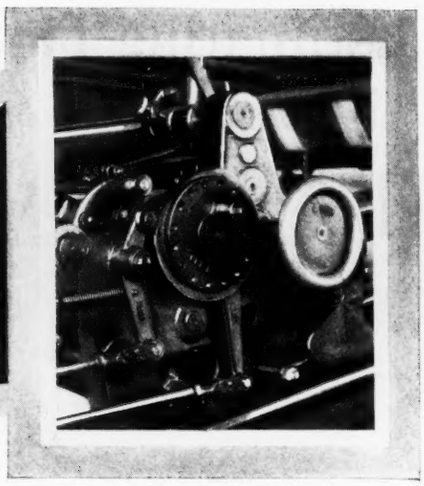
$$X = \frac{36 \times 11.144}{90 \times 0.048} = 92.87 \text{ minutes}$$

Thus the time per gear blank is $\frac{92.87}{5} = 18.57$ minutes.

* * *

Twenty-six per cent of the domestic consumption of nickel and thirty-one per cent of the domestic production of lead is used in connection with the automotive industry. Thirty-seven per cent of the aluminum production in the United States and fifteen per cent of the copper production also goes into this industry.

Ingenious Mechanical Movements



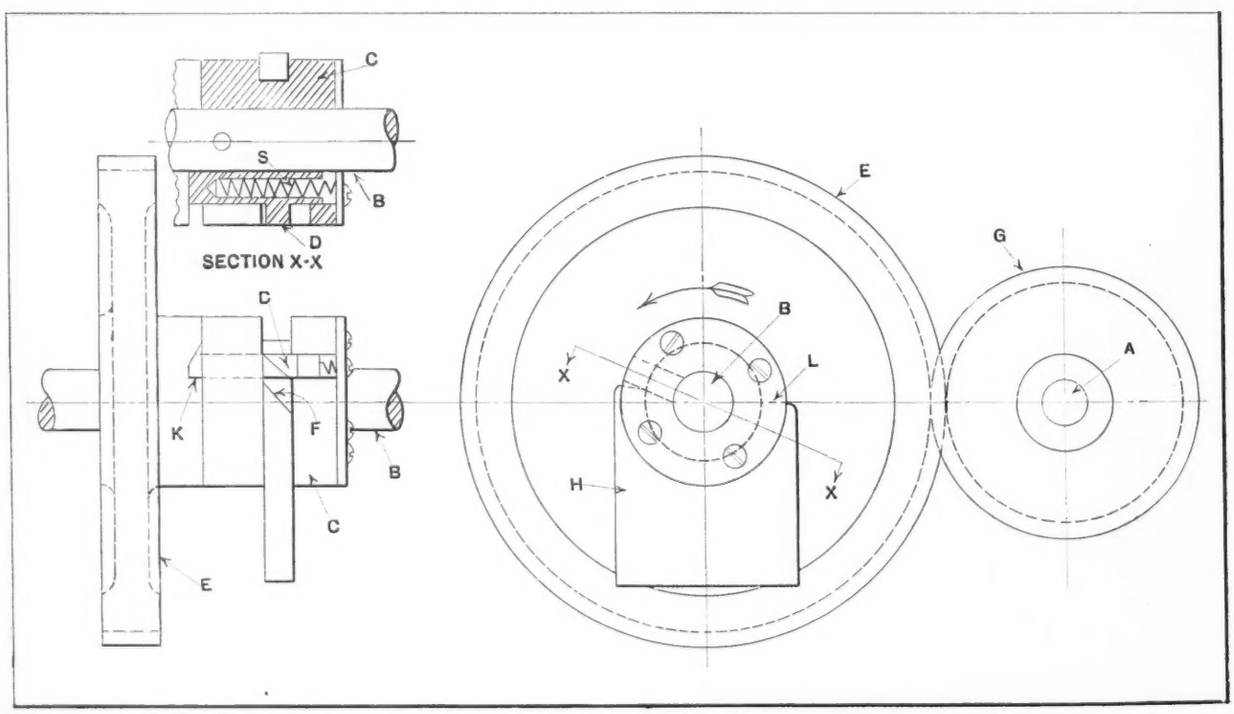
INTERMITTENT MOTION FOR GEAR-DRIVEN SHAFT

By W. E. GUNNERSON

The shaft *A* of the drive shown diagrammatically in the accompanying illustration is required to make a revolution and then stop or dwell for a period equivalent to one revolution. Shaft *A* is driven by shaft *B*, which rotates continuously. The gear *G* is keyed to shaft *A* and meshes with the gear *E*, which is a running fit on shaft *B*, while the sleeve *C* is pinned to the driving shaft *B*. When the drive is in operation, the clutch dog *D*, which is a sliding fit in a slot in sleeve *C*, drives gear *E* one-half revolution; then as the angular face on the dog comes in contact with the angular or cam face *F* of the stationary piece *H*, the dog is withdrawn from contact with gear *E* at point *K*, allowing gear *E* to remain stationary while shaft *B* makes one-half revolution.

After shaft *B* has made one-half revolution, the dog *D* passes out of contact with the piece *H* at point *L*, allowing the dog to re-engage gear *E* through the action of spring *S*. Gear *E* then makes one-half revolution, following which the cycle of movements described is repeated. Thus gear *E* rotates one-half revolution and then remains stationary while shaft *B* rotates one-half revolution.

As gears *E* and *G* have a driving ratio of 2 to 1, gear *G* is given the required intermittent motion. A wide range in the timing of the intermittent motion may be obtained by varying the ratio of the gears and the length of the actuating or cam surface of the piece *H*.



Intermittent Gear Drive Actuated by Cam-operated Clutch Dog

TRANSFER MECHANISM FOR WIRES AND RODS

By H. C. TEN HORN

When parts such as wires, rods, or spokes must be transferred automatically from a cutting-off machine to a thread-rolling machine, the mechanism shown diagrammatically by the front elevation and plan views, Fig. 1, may be utilized with more or less modification as to the exact arrangement. This particular mechanism transfers wire blanks from the chute *A* of the cutting-off machine to a duplex type of thread-rolling machine which rolls a thread first on one end of the wire blank or rod and then on the opposite end. One of the thread-rolling slides *J* has a horizontal reciprocating movement derived from crank *Z*, and the other thread-rolling slide *S* has a vertical reciprocating motion derived from crank *Y*.

As the unthreaded wire blanks emerge from the lower end of the chute or hopper *A*, they are transferred to the thread-rolling machine by the two parallel square-threaded screws *B* and *C*. These screws have a pitch of 1 inch, but there is a wide space between the threads, as indicated by the plan view. Both screws rotate, of course, at the same speed, and once during each revolution they turn to an "open" position which permits one

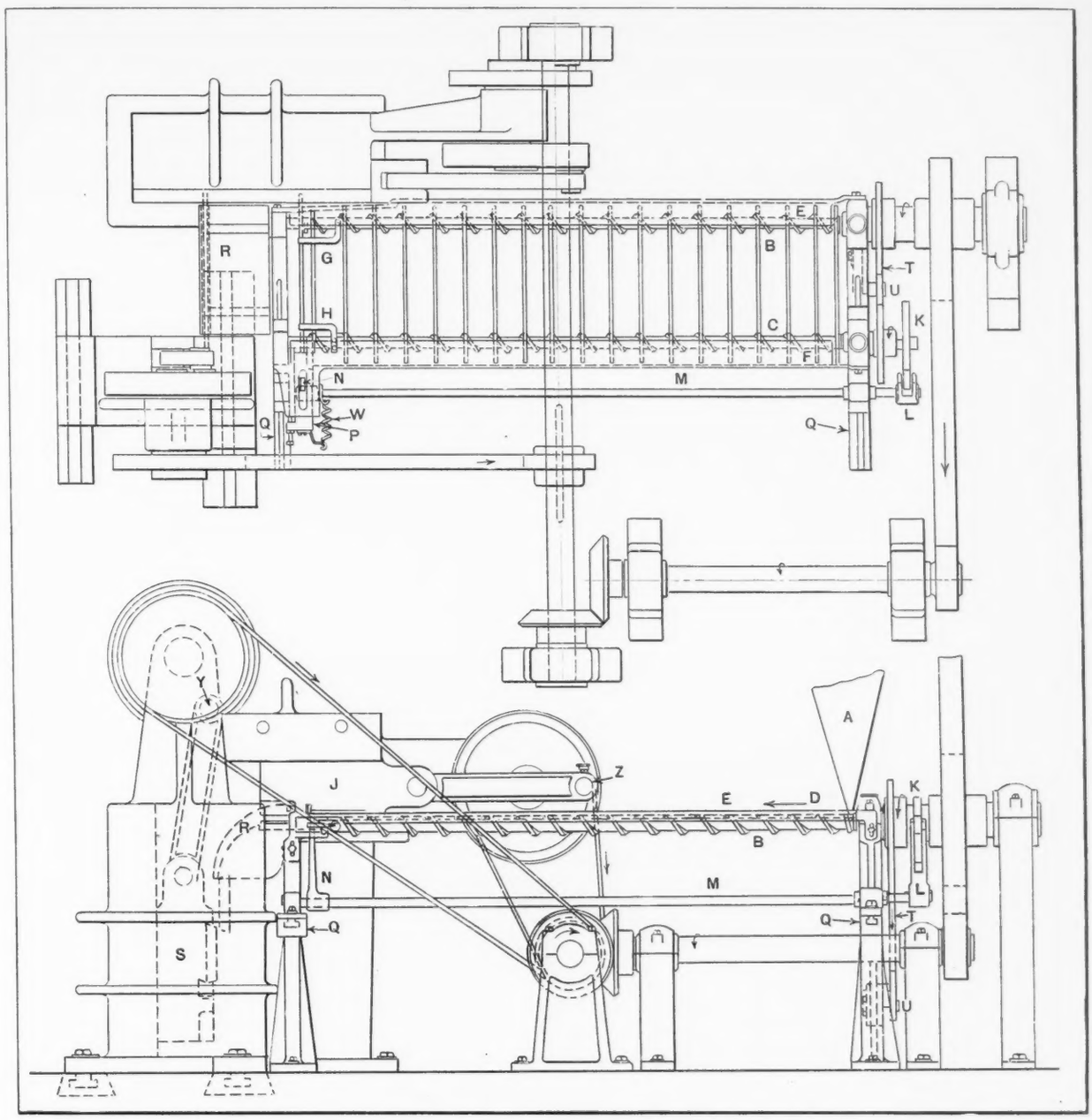


Fig. 1. Front Elevation and Plan View of Mechanism for Automatically Transferring Wire Blanks from Cutting-off Machine to Thread-rolling Machine

rod from chute *A* to drop on the screws. The next wire blank now rests on top of the thread, and is thus prevented from leaving the chute until both screws, which occupy the same relative positions, have again returned to the "open" position. (See cross-section of lower end of chute *A*, Fig. 2.) As the screws revolve, the wire blank which falls from the chute each revolution is transferred from right to left, as shown by the plan view, Fig. 1. The wires are prevented from climbing over or rolling from the feed-screws by guides *E* and *F*, the shape and location of which are shown more clearly in Fig. 2 (see upper cross-sectional view).

At the left-hand end of each screw there is a short unthreaded space where the wire blanks are held in place by two leaf springs *G* and *H* (see plan view, Fig. 1). Just before the thread-rolling slide *J* begins its working stroke, a wire blank is pushed across to the proper thread-rolling position by a sliding block or plunger *P*. The movement of this plunger is at right angles to the feed-screws, and it is operated through lever *N*, shaft *M*, lever *L*, and cam *K*, in conjunction with a spring *W*. The movement of plunger *P* is limited by an adjustable screw, and the connection between this plunger and lever *N* is shown by the sectional view, Fig. 2.

As soon as a wire blank is in position, slide *J*, Fig. 1, moves to the left, thus rolling the blank between the flat threading die on slide *J* and the stationary threading die beneath it. The partly threaded blank then falls into chute *R*, at the lower end of which it is held by a flat spring until the vertical thread rolling slide *S* is in position to begin another working stroke; then the wire blank is removed by the action of a push-finger which starts it between the dies.

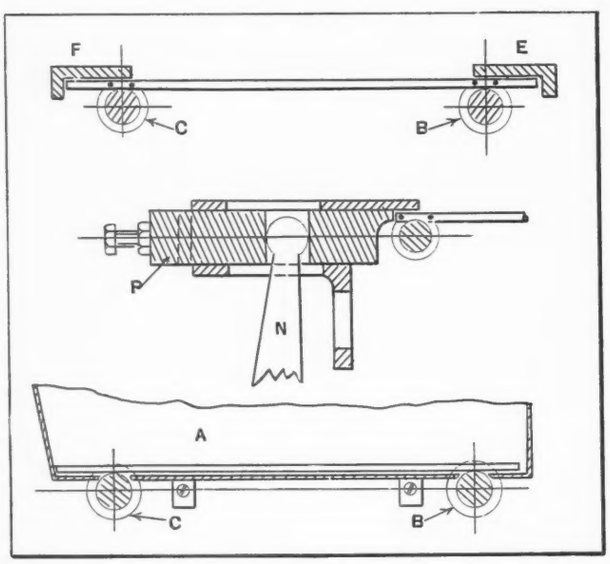


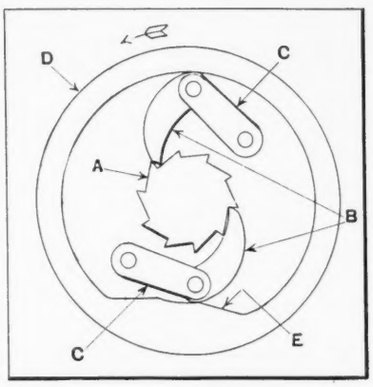
Fig. 2. Details of Mechanism Shown in Fig. 1

The entire mechanism is so designed that it can be adjusted for handling different wire diameters and lengths. For example, the bearings that hold feed-screw *C*, together with plunger *P* and its cam-operating mechanism, can be adjusted along the ways *Q* for varying the distance between screws *B* and *C* to suit the length of the wires or rods to be threaded. The driving chain *T* passes over an idler *U* (see front elevation and plan views), which may be raised or lowered to lengthen or shorten the chain drive in accordance with the position of screw *C*. Silent chain transmissions have been used quite generally to provide a simple means of timing the different movements properly.

* * *

CONVERTING CONTINUOUS INTO INTERMITTENT MOTION

The mechanism here described was designed to impart an intermittent circular motion to a driven shaft from a constantly revolving driver. In the illustration, two pawls *B* are shown, one at the inner and one at the outer position. These pawls are pivoted in the free ends of links *C*, while the other ends of the links pivot on studs screwed into the stationary bearing of the driven shaft.



Intermittent Motion Imparted by a Cam Acting Against Pawls

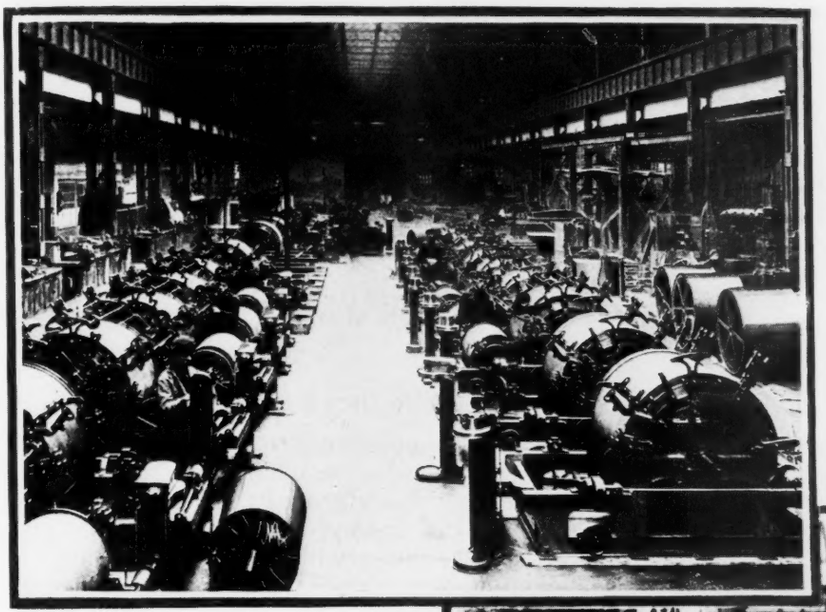
When the driving member *D* carrying the cam *E* is revolved 180 degrees in the direction of the arrow, the inner pawl will be released and the outer one pushed into the inner position, giving the ratchet wheel *A*, which is mounted on the driven shaft, a fractional circular motion. The pawls are returned by means of springs (not shown) to their outer position as they are released by the cam. The number of circular movements of the ratchet per revolution of the driver may be varied by changing the number of cams or pawls or the number of teeth in the ratchet wheel.

* * *

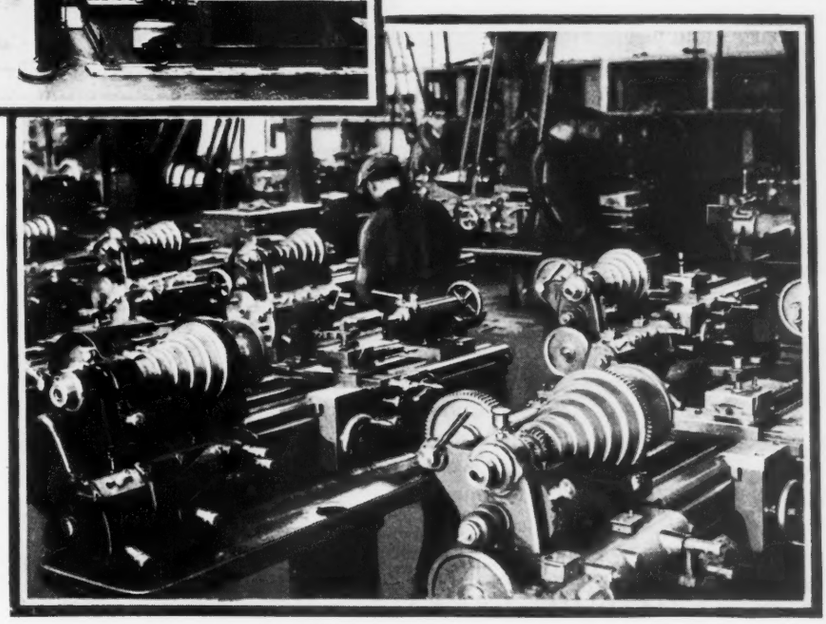
One of the recent developments in aviation lighting can be traced directly to Colonel Charles A. Lindbergh. Overhearing a remark made by him during a visit to the General Electric Co.'s research laboratory, that "flashings made by the poles of trolley cars are noticeable when flying in a dense fog, even though other lights are not distinguishable," Dr. Irving Langmuir, assistant director of the laboratory, set about experimenting with apparatus that would produce such a flash. The experiments resulted in the building of an electric flasher of a new type. Code signals will guard aviators against mistaking a trolley flash for the beacon. A definite plan of airport signal will inform the flyer of his exact location.

Notes and Comment on Engineering Topics

British railway companies have been rather slow to adopt motor trucks in place of the horses used for their delivery service. One company alone employs 7800 horses at the present time. The railroads have demanded from the truck manufacturers that they develop a truck that will do the work of a horse at the cost of a horse. As a result of experiments, a "mechanical horse" has been introduced which will perform the work of two horses at about two-thirds the cost of two horses. The new design consists of a three-wheeled tractor with a seven-horsepower engine which will haul a three-ton load at a speed of fifteen miles per hour, using the present horse wagons for carrying the load. The new tractor has a single front wheel one foot in diameter and two larger rear wheels. An arrangement is provided by means of which the front axle of the wagon can be lifted, so that its weight is transferred to the tractor. An advantage claimed for this arrangement is that the present type of wagons can be utilized. The difference between British and American methods is well exemplified in the handling of this problem.



The Soviet Union built during the fiscal year ended last June, in round figures, 9650 internal combustion engines, 400 Diesel engines, 30 steam turbines, 48 hydraulic turbines, 4400 automobiles, 430 portable steam engines, 5950 steam boilers, and 14,000 textile machines of various types. The illustration to the left shows combing machines being assembled at the Karl Marx Works in Leningrad.



The illustration to the right shows engine lathes in the final stage of assembly at the Leningrad Sverdlov Engine Lathe Works of the Soviet Republic. According to the Economic Review of the Soviet Union, over 12,000 metal-cutting lathes of different sizes were produced during the fiscal year 1929-1930. The design of the lathes is such as is deemed to be best adapted to the new Soviet machinery industries.

THE WORLD'S LARGEST CRANE

One of the world's outstanding pieces of machinery was recently completed in Collingwood, Ontario. It is a gate-lifting crane said to be the most powerful in the world. It will be permanently located at Port Weller, the Lake Ontario entrance to the Welland Canal. The crane has a capacity for lifting 500 tons vertically, and has been constructed for use in cases of emergency to lift the huge canal lock gates, each leaf of which weighs 500 tons.

Current Editorial Comment

In the Machine-building and Kindred Industries

TIME TO REPLACE OLD EQUIPMENT

Andrew Carnegie built up the largest industrial enterprise of his day controlled by one man. One of the methods by which he increased the profits of his business was to add to his manufacturing facilities and to install improved equipment in times of business depression. In that way, the installation and rearrangement of machinery could be accomplished more cheaply and with less confusion than if done when the mills were in active operation; and when the rush of business came back, production was not hampered by inadequate facilities.

The steel industry generally has continued to follow these methods. The few builders of machinery that are busy today are almost entirely makers of steel mill equipment. The experienced heads of the large steel companies realize fully the need for being ready when business activity returns. Unfortunately, this cannot be said of most of the other industries of the country. While there are many obvious advantages of installing needed equipment at the present time, little of this is being done.

In the machine shop industries, the average age of the equipment today appears to be greater than it was four years ago, indicating that the activity in installing new machinery during 1928 and 1929 was not sufficient to replace all the machinery that became superannuated during those years. Recent surveys show that in the installation of new equipment, the machine shop industries are running behind rather than ahead of the average condition of four years ago.

Would this not be a good time to follow the practice that has been applied so successfully in the steel industry? Is it not good business to install new equipment now rather than to do it later and interfere with production? Conditions—including the credit situation—are favorable for making needed replacements right now.

* * *

TRAINING STUDENTS IN THE USE OF TECHNICAL JOURNALS

In the past, engineering students were trained to obtain information mainly from books; but engineering moves forward so rapidly these days that books furnish a satisfactory basis for engineering education only when supplemented by the information on current advances in industry that is furnished by technical journals.

For this reason many engineering schools have recently included a study of current engineering periodicals in their regular curriculum. The students are expected to read a number of these journals regularly and to prepare comments on and abstracts of outstanding articles.

This is an important phase of engineering training. When the young man leaves college, he must continue to study engineering if he expects to keep up with the rapid advances in his chosen field of endeavor. A most effective way of keeping informed is by reading the leading engineering journals. The habit of reading and consulting these journals should be formed while he is still a student. The ability to pick out articles of special importance should be developed through a carefully planned course of instruction. Colleges that do this are equipping their students with a valuable means of becoming and remaining well informed engineers. Their efforts should be commended.

* * *

ASKING FOR DRAWINGS WITH BIDS

The practice of asking for detailed working drawings with bids on machine equipment is one that machinery manufacturers should discourage. The action taken by the National Electrical Manufacturers' Association with regard to this matter is one that other machinery associations might well consider. This Association has adopted a resolution recording its formal opposition to the practice. The resolution states that as the practice of requiring detailed working drawings with bids, or as a part of a contract, is objectionable and works a hardship on the manufacturer, it should be discouraged. To furnish detailed working drawings with bids not only is an unnecessary expense, but also involves the giving out of information which is the result of the manufacturer's research and experience, and to which the prospective customer has no possible claim or right.

* * *

PERFECTION IS NOT ALWAYS DESIRABLE

In designing a machine or tool, the aim of the designer should be to produce equipment that will prove satisfactory for a majority of applications at a reasonable price. If the designer aims at perfection, or tries to design a machine that will be so universal in character that it will be applicable to an unusually wide range of work, it is likely that the cost will be so great that the machine will be commercially unprofitable.

A good designer must combine commercial judgment with engineering ingenuity and technical skill. The most perfect design technically may prove to be so expensive to build that it becomes unprofitable, because its sale is too limited.

Making Apprenticeship Training Worthwhile

A Review of Successful Methods Used in Training Apprentices, and Suggestions that will Help Make the Training Effective

By C. J. HARTER, General Manager
Harter Educational and Engineering Service
West Boylston, Mass.

IN the previous articles by the author on the subject of apprentice training, published in the October and November numbers of MACHINERY, the need for thoroughgoing apprentice training in the machinery industries has been emphasized, and the factors that must be taken into consideration in planning a training course have been explained. In the present article, general methods of establishing and maintaining training courses will be described.

There are two distinct types of systems in use for training apprentices—the vestibule school and the departmental training method. In the vestibule type of apprentice training, the boys obtain their practical experience in a specially equipped shop or department, where they are under the direct supervision of instructors who assist them in the operation of machine tools and other shop equipment. While there are some successful examples of this type of training, in most cases all that the apprentice gets in the vestibule type of training are the elements of his trade.

C. J. Harter

It is practically impossible to reproduce, in a vestibule department or in any other type of school, the conditions that exist in the production departments of plants; hence, in many instances, a considerable length of time is required, when the training is completed, to fit the boys into their place in the production departments, and they may never reach the same degree of efficiency and skill that they would if trained directly in the shop.

The expense of maintaining a vestibule school for apprentice training is greater than the cost of training the boys in the shop departments. In the first place, the supervision expense is much greater. More time is required to bring the boys to a fair degree of efficiency, and the overhead represented by plant and equipment is a considerable item. In one plant, an old apprentice is put in charge of a new one, and, for the first few months, no production of any account is obtained from a new boy. Only very large concerns can afford to employ this plan.

In the departmental plan of apprentice training, the apprentice is trained directly in the shop. Under this plan, he serves in each department a predetermined number of hours; the schedule, however, must be flexible, so that it will not interfere with the regular routine of production in the plant. Generally, production conditions are improved, because the apprentices can act as an emergency crew and assist departments that may have an unusual amount of work over short periods, as there are always boys available who have had experience on the required work.

Boys develop more rapidly under the departmental type of training. They work under regular production conditions and are in direct contact with skilled mechanics. In this way, they soon learn what speed and accuracy in production mean, which is a big factor in their success. They are also in a position to become familiar with the system in the shop. The departmental training method permits the boys to be trained at a reasonable expense, as the cost of supervision is offset by the productive work they do.

Apprenticeship Agreements Should be Carefully Worded

To avoid any misunderstanding between the apprentice, his parents, and the company, it is advisable that an agreement or indenture be executed. This indenture not only eliminates all possibilities of misunderstanding, but also creates more respect on the part of the apprentice for his course. It gives the whole transaction more dignity.

The agreement should be considered by both parties as a mutual promise of performance and good faith, and should not be looked upon as a contract. No steps should be taken to enforce the agreement if it is violated by the apprentice, because an unwilling apprentice is not an asset to the company.

Provisions should be made for an honorable termination of the agreement—either by the apprentice or by the company—upon presentation of adequate reasons by the apprentice or for just cause

C. J. HARTER was born in Herkimer, N. Y., in 1881. His early education was obtained in the public schools of Herkimer, and this was supplemented by "burning the midnight oil." He started work in an electroplating plant and soon became assistant foreman on this work. In 1905, he began to design jigs and fixtures for the Remington Arms Co., becoming first assistant chief draftsman and then chief draftsman and technical advisor to the purchasing department. During the World War he was engineer in charge of equipment for the small arms arsenal built by the Pratt & Whitney Co. for the Chinese Government, and later held important executive positions with the Bilton Machine Tool Co., the H. H. Franklin Mfg. Co., and the Reed-Prentice Co. In 1923, he became educational director of the Norton Co., in charge of all training of apprentices and sales employes. In 1928, he organized the Harter Educational and Engineering Service, of which he is general manager. In this capacity, he organizes and supervises apprentice and other trade training programs for a large number of manufacturers.

by the company. The agreement should also provide for a decrease in working hours when production conditions make this necessary; and, also, for a complete suspension of the agreement, if business conditions require the closing of the plant. Those suspended because of business conditions should have the option of resuming their course before any additional apprentices are hired. The right of suspension for violation of rules or for unsatisfactory work is also frequently part of the agreement, in which case, however, the boy may be reinstated if it seems advisable.

How to Stimulate the Interest of the Apprentice

Most troubles in handling apprentices are due to the fact that those who have charge of them do not recognize that the mental processes of a boy are not always the same as those of an adult. The duties of the supervisor extend beyond the working hours, and it is advisable for him to check up the habits of the apprentice frequently, making sure how he is spending his spare time. Friendly talks with the boy, and sometimes a conference with his parents, are necessary to prevent him from using his spare time in ways that are detrimental to himself.

Men experienced in the training of apprentices agree that most of the troubles encountered in handling young boys are due to the fact that those in charge of them do not recognize that the mental processes of a boy are not always the same as those of an adult. The duties of the apprentice supervisor extend beyond the working hours. He should know something about how the boys are spending their spare time. Friendly talks with a boy, and sometimes a conference with his parents, are necessary to prevent him from using his spare time in ways that are detrimental to himself. Many boys also require encouragement throughout their course. That kind of boy often develops into the highest type of skilled workman, if properly encouraged at home as well as in the shop.

There are various ways in which the interest of the apprentice may be stimulated. In many plants, clubs and associations are formed, and sports and other recreational activities are fostered by the company and the supervisor. This promotes a spirit of loyalty to the organization, because the boys feel that they belong to a definite group.

To stimulate the interest of the apprentice in the course itself, it is advisable to make it part of the agreement that he will be presented with a kit of tools upon graduation. Usually, these tools are lent to him after he has passed the probation period, as they are required in his work; then, when he graduates, they become his personal property. As an incentive to the boy to complete his training, many firms pay him a bonus—usually $100—upon graduation.

The interest of the parents must also be stimulated. If the parents are not interested in the training, the best results cannot be obtained. This is particularly true with the type of boy who requires much encouragement throughout his course. Very often such a boy will develop into the highest type of skilled worker, if properly encouraged at home as well as in the shop.

To stimulate the interest of the parents is an important duty of the apprentice supervisor. This requires a great deal of tact and understanding. Only an experienced supervisor is likely to handle this phase of the training problem to the best advantage. Generally, a supervisor who has brought up boys of his own is to be preferred, as he can best appreciate the reactions of the boys and their parents.

The Importance of Rates of Pay Must not be Overlooked

The compensation of the apprentice must be high enough to attract the best type of boy. In the past, the rates of pay have been set too low, with the result that the boys were likely to stay on the job only until they were able to get something else that would pay a higher wage.

To counteract the tendency of the boys to leave before the completion of the training course, the rates of pay should be set as high as possible, commensurate with the cost of providing the training for the boys. It is not feasible to lay down definite rules as to what the rates should be, as they would naturally vary in different cities and in different parts of the country. In several places in New England, it has been found satisfactory to pay 25 cents an hour for the first six months, increasing this rate 3 cents an hour every six months during the first three years, and 5 cents an hour every six months during the fourth year. This results in rates as follows: 25 and 28 cents an hour for the first year; 31 and 34 cents during the second year; 37 and 40 cents during the third year; and 45 and 50 cents during the fourth year.

Boys who have graduated from a recognized trade school or who have had shop experience equivalent to about one year of apprentice training should receive credit for one year; their apprentice course should be of only three years duration.

Apprentice Training Records

Complete records are essential to the success of an apprentice system of training. These records should show the number of hours that the boy has spent in each department, his pay increases, the date of transfer from department to department, his class record, and other information of value in determining the ability of the boy. A record should also be kept of the boy's progress in the various departments as reported by the foremen; and if he shows weak points during the training period, he should be given the required additional training during the last year of the course. The records should be brief, but definite and accurate.

Apprentices Must be Given Classroom Training

Unless the apprentice graduates with a thorough knowledge of the technical side of his trade, a poor job has been done in training him and he will not develop into the highest type of skilled man. His classroom training can best be handled right in the plant, as he will take more interest in his studies if he feels that he is receiving instruction that has been especially designed to make him more useful in his work.

The conditions in no two plants are exactly alike, and for that reason, a course that may be suitable in one plant cannot always be applied in another plant with equal success. In almost every shop, there are certain subjects that should be taught to meet special manufacturing conditions. The instructor should be an experienced shop man who will always have the practical value of the instruction in mind. A closer supervision is also possible if the classroom training is handled on an individual basis, rather than as vocational school or evening class work.

The ultimate object of training apprentices is, of course, to obtain a permanent supply of skilled men; but, unless certain general rules are observed, the graduates are likely to leave the parent company upon graduation.

Many companies have made the mistake of thinking that because the boys have worked for a low wage during their training, they should continue to do so after graduation. The result is that the most promising boys are lost after their training is completed. In the writer's experience, an increase of 5 cents per hour for the first year, and a similar increase for each succeeding year until the young man receives a full journeyman's wage, has proved a satisfactory solution of this problem. One company has followed a plan such as outlined, and has not lost any graduate apprentices over a period of several years. Special consideration has been given, of course, to unusual cases, and the men who showed outstanding ability have been compensated in accordance with the value of their work.

Gears Made from Zinc-Alloy Die-Castings

In a paper read before the annual meeting of the Society of Automotive Engineers at Detroit, January 19 to 23, Robert M. Curts of the New Jersey Zinc Co., New York City, presented some valuable information on the many uses of zinc and zinc alloys in the automotive industry. One part of his paper related to the use of die-cast zinc alloy gears, from which the following paragraphs are quoted.

While die-cast gears made of zinc-base alloys have certain obvious limitations, their properties are such as to merit consideration when proper lubricants can be used and when the loads are reasonable. Several years ago, a rather thorough investigation was undertaken in a technical-school laboratory in cooperation with engineers of a company that specialized in manufacturing gears. The principal object of this investigation was to study the wear resistance of zinc-base die-cast gears in comparison with standard cut brass gears. The results were so decidedly in favor of the die-cast gears that further tests were made in comparison with cut gears of cast iron and of steel. The results of these investigations are briefly summarized as follows:

1. Die-cast zinc-alloy gears deteriorate more rapidly than cut brass gears when lubricants containing acid animal-fat are used.

2. When no lubricant was used and when lubricants showing no acid reaction were employed, the die-cast zinc-alloy gears showed a marked superiority over brass gears with regard to wear.

3. Cut brass gears have better wearing qualities than die-cast zinc gears when kept thoroughly lubricated with light mineral oil.

4. Cast-iron gears were better than die-cast zinc gears under the same conditions as those mentioned in paragraph 3.

5. When the gears are run dry, the die-cast zinc-alloy gears are superior to steel gears.

6. The die-cast zinc-alloy gears broke under a load of 3461 pounds per inch of face, as compared with 1996 pounds per inch of face for cast iron.

While the foregoing tests are not complete in every respect, they indicate definitely that, when the proper alloy is used, a die-cast zinc-alloy gear has relatively good wearing properties, especially when a lubricant cannot be constantly applied; and that, in comparison with cast iron, the impact strength of the zinc alloy is much greater than that of cast iron. This is further substantiated by the Charpy impact test. At present, die-cast zinc-alloy gears are used successfully in assemblies for regulating seats, windows, and windshields. They are also used in connection with the roadside gasoline pump. No doubt they would serve equally well in other places.

* * *

Since 1930 was a rather quiet year in most industries, it is of interest to note that the A. O. Smith Corporation of Milwaukee, Wis., shipped last year, 472,000 tons of electrically welded pipe to various parts of the United States, as compared with 425,000 tons in 1929. The company made extensive additions to its works during the year. A new research and administration building was erected at a cost of about $1,500,000. Two other buildings for experimental and manufacturing purposes were also erected during the year.

Weighing Thin Sheets to Measure Thickness

Metal Sheets as Thin as 0.00025 Inch, Which Cannot be Measured Accurately in the Usual Way, are Weighed to Determine their Thickness

By F. V. HARTMAN, Mechanical Engineer, Research Laboratories
Aluminum Company of America, New Kensington, Pa.

MEASURING the thickness of aluminum, lead, and tin foil is somewhat different from measuring the thickness of ordinary sheet or plate stock, and is considerably more difficult. Most foil is rolled to a thickness of 0.001 inch or less, and a great deal of it is only about 0.00025 inch thick. Obviously, material of such a thin gage cannot be measured accurately with the ordinary screw type of micrometer.

Thickness Determined by Means of Balance Scales

One method employed for measuring the thickness of foil is to weigh a specimen of known area in order to determine the number of square inches of surface per pound. From this value the thickness may be obtained through a knowledge of the specific gravity of the material. For this method, an accurate and sensitive balance is used. It is graduated to read the area in square inches per pound, corresponding to the area of the specimen.

One such type of balance is illustrated in Fig. 1. In using this balance, it is of the utmost importance that the specimen to be weighed be accurately cut to size. A method often employed for doing this is to hold the strip foil between a pair of flat templets (usually square) of the desired area, and then cut out the specimen by running a sharp knife around their edges. However, this method is not very convenient, and is likely to result in considerable error if the specimen is not cut carefully. A very sharp knife is necessary, and it must be handled so as to sever the foil exactly at the edges of the templets. Another source of error may also result from the templets becoming worn around their edges so that the specimen is cut under size.

Fig. 1. Scale for Weighing Aluminum Specimens to Determine their Thickness

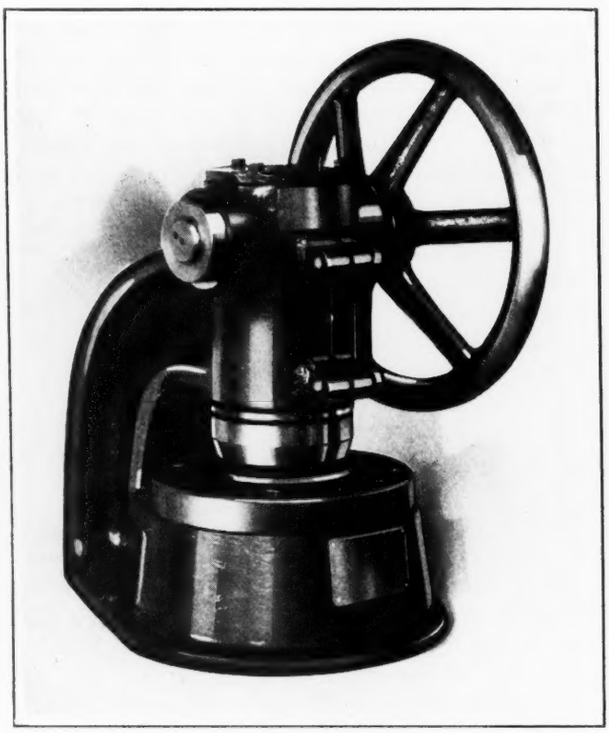


Fig. 2. Hand-operated Press for Blanking the Specimens Weighed on the Scale Shown in Fig. 1

Another method of producing specimens that has proved very satisfactory is to blank them out in a small punch press, obtaining a round specimen instead of a square one. Such a punch has been designed and built by the Aluminum Research Laboratories of the Aluminum Company of America for use in their foil plants. The press for this class of work is a rather specialized piece of equipment, and some interesting problems are involved in its design and construction. For instance, it must be capable of cutting foil 0.00025 inch thick with edges clean and free from burrs.

The balance scale used for weighing the specimens is graduated to correspond to a specimen area of 16 square inches. However, as a rather large punch would be needed to shear a specimen having

an area of this size, it was decided to build a press having a punch that would blank a specimen having an area of only 8 square inches. Two thicknesses could then be cut simultaneously in order to produce a specimen of the proper area to be weighed on the balance. The press was, therefore, designed to blank a specimen having a diameter of 3.1915 inches.

Close Fitting Punch and Die Required to Insure an Accurately Blanked Specimen

The press is shown in Figs. 2 and 3. Probably the most important requisite of the punch used is that it must fit properly in the die. With an appreciable clearance between these two members, it would be impossible to shear extremely thin foil so as to obtain an accurate edge. When foil as thin as 0.00025 inch is to be sheared, a slight clearance between the punch and die would cause a drawing action to take place, which would result in blanking a specimen with edges drawn over into a shallow cup. Consequently, a light press fit of the punch in the die is necessary.

The die members were made of heat-treated tool steel and were ground to a fine finish, care being taken in the selection of the steel and its heat-treatment in order to minimize the tendency to warp, particularly during the grinding operation. It was found that better results could be obtained by using 1.10 to 1.20 per cent carbon steel and giving it a light draw after quenching in water. Even then some warping was experienced while grinding, which necessitated special care in measuring to insure an accurate cylindrical surface. The expansion of the die members due to increase in temperature was also a factor given consideration when they were measured during the final grinding operation.

All Important Surfaces on Press are Ground for Accuracy

In grinding the die and assembling it in the die-holder, the cylindrical surface was ground first, after which it was pressed into the holder. Both die and die-holder were then chucked in a grinder and the bottom surfaces of the two were ground. Next the parts were reversed and the top surface of the die and the inside diameter were ground. Precautions were taken not to chuck the work too tightly in order to prevent its springing. The procedure described was necessary to insure having a common bottom surface for the die and the die-holder, with the top surface of the die parallel and the bore perpendicular. The holder is secured to the punch frame by means of four cap-screws, and is accurately located by two tapered dowels, so that it can be easily removed for grinding.

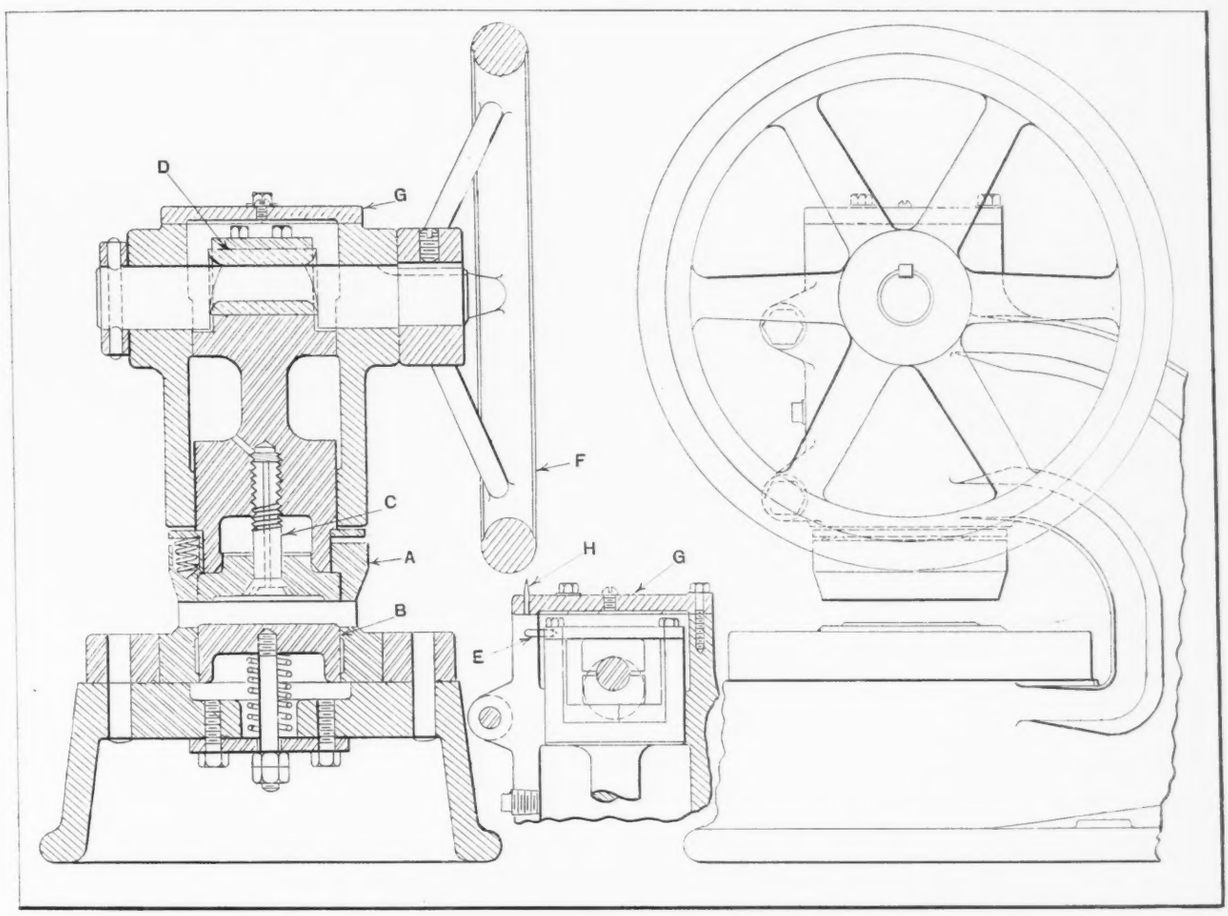


Fig. 3. Construction of Press Shown in Fig. 2, in which Compensation is Made for the Sharpening of the Die Members by Inverting the Cross-head

In order to keep the die and punch in perfect alignment and to minimize springing or deflection in the frame during the punching operation, the frame was made unusually heavy. The plunger or punch-head was made a close sliding fit in the barrel of the frame, and provision was made for adjusting for wear so that this close fit could be maintained. As shown in Figs. 2 and 3, this adjustment is obtained by means of two cap-screws which clamp the split barrel at each end, a standard tapered pipe plug serving to adjust the diameter of the bore.

The bore must be accurately machined to size to fit the plunger. This operation is accomplished in a boring mill, and the die-supporting surface is machined off in the same setting in order to insure its being square with the bore. After the barrel has been bored, the holes for the adjusting cap-screws and pipe plug are drilled and tapped. The barrel is then split. This may cause some warping, but that can be taken care of by means of the adjusting screws and pipe plug at the time the plunger is fitted to the barrel.

A hold-down ring *A*, Fig. 3, is provided to clamp the foil to the die during the punching operation. This ring is backed up by three springs to produce the required pressure on the foil. The counterbore in the ring is machined approximately 0.006 inch deeper than the outer thickness of the punch around which it fits. In other words, the ring is normally slightly in advance of the punch to insure that the foil will be clamped before the punch enters the die. However, it is necessary to avoid having the ring advanced too far ahead of the punch, as in that case, it would act as an inverted die and the ejector pad *B* would act as a punch, drawing the specimen into a shallow cup before the shearing takes place. Obviously, this would result in the specimen having too large an area. The corner of pad *B* is beveled to facilitate sliding the foil between the punch and the die. This pad not only ejects the specimen from the die, but also scrapes the inside of the die, keeping the latter free from dirt.

As indicated, an air vent hole is provided for the punch, passing through the screw *C* and out of the side of the plunger. The object of this vent is to prevent the formation of a partial vacuum behind the specimen, which would make its removal difficult. This is an important feature, and is of considerable help when very thin foil is being blanked.

Crankshaft of Unusual Construction

A crankshaft with only a very short throw is necessary for this class of work. In order to simplify its construction and obviate the need for a forging, the crank is turned from a piece of steel shafting 1 3/8 inches in diameter, and the central portion is turned to 3/4 inch diameter, eccentric with the center of the shaft. This makes possible a crank having a 5/8-inch stroke. To simplify the construction further, the usual connecting-rod is eliminated by the use of the split block *D* which serves as a crankpin bearing and slide cross-head.

The block *D* slides horizontally in a square recess machined in the top of the plunger, and adjustment to allow for regrinding of the punch and die is also provided in this block. To obtain this adjustment, the block is made in two halves and is split 1/32 inch off center, making one of the halves 1/16 inch thicker than the other. Thus, when metal has been ground off the end of the punch and the upper surface of the die to such an extent that the punch no longer enters the die sufficiently, the block can be reversed to lower the punch and plunger assembly.

A flat plate is fastened to the top of the plunger to retain this block in the square recess. A small steel pin *E*, driven in the edge of the plate, slides in the slot of the barrel to prevent rotation of the plunger and cramping of the block *D* in the recess. Another plate *G*, secured to the top of the barrel, serves to cover the working parts and can be easily removed to provide access to the enclosed parts. The punch is operated by the cast-iron handwheel *F*. The handwheel is fastened to one end of the crankshaft by a key and set-screw, while a plain collar, secured at the other end, prevents end movement of the shaft.

Lubrication of the crankshaft bearings is provided for by means of a small hole over each bearing. The block *D* and the plunger are lubricated through an oil-hole drilled in the center of the plate *G*. This hole is tapped for a small machine screw which serves as a cover to exclude the dirt. The pad *B* is lubricated by applying oil around its top edge.

After the specimen has been punched, it is necessary to lance it so that it can be hung on the small wire hook on the balance scale. A tool-steel spike is provided for this purpose. It is mounted in the plate *G* at *H*.

More than a dozen presses like the one described have been built and are operating satisfactorily. A number of these have been in continuous use for almost eight years for gaging foil products in the mill. During this time, they have required no adjustments or repairing nor have the dies been reground.

Blueprint Room Planned for Economy

March MACHINERY will contain an article showing the plan and describing the equipment of a blueprinting department in which two men are able to make more than ten thousand blueprints per month. To keep the expense of blueprinting at a minimum, it is essential that suitable equipment be provided and that it be so arranged that the process of making prints can be carried through with as little lost motion as possible. A prominent machine tool builder recently constructed a new office building. At that time considerable thought was given to the planning of a blueprinting room arranged for convenience and efficiency. It is this blueprinting room which will be described in March MACHINERY.

A Simplified Time Study for a Tool-room Bonus System

Tool-room Bonus System that has Increased Production 50 Per Cent and Wages 25 Per Cent

By T. Turner, Time Study Supervisor, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

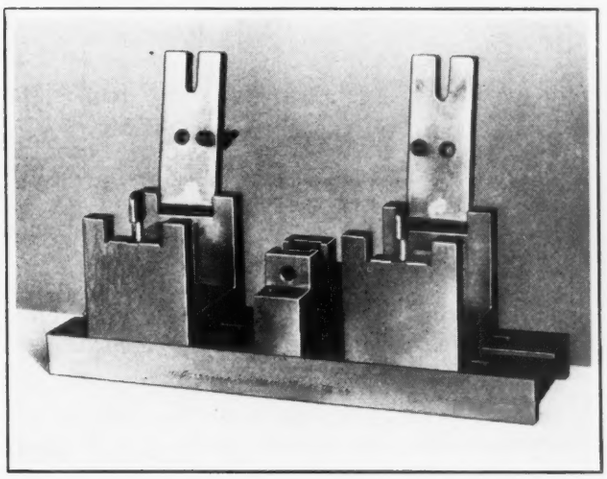


Fig. 1. Example of Drill Jig Built on the Bonus Basis

MANY reasons have been advanced to show why a bonus system cannot be applied successfully to tool-room work. Two of the main objections are the non-repetitive nature of the work and the high degree of accuracy required. Nevertheless, these objections can be overcome.

It is true that there is very little duplication of jobs in the tool-room, except when several tools of the same design are required; but even though one tool may be different from others, similar operations must be performed on all. Time studies can be made for these operations; and when each job is resolved into its individual operations, the problem of applying a bonus system is not very different from that met with in regular production work.

Reasoning along these lines, the Westinghouse Electric & Mfg. Co. has installed an incentive wage system in the tool-room of its plant. As a result, tool production has been increased about 50 per cent over that obtained on a day-work basis. Moreover, the earnings of the workmen have been increased 25 per cent. All this is due directly to the incentive furnished by a bonus amounting to approximately 11 per cent of the toolmakers' hourly rate.

The System has Improved the Workmanship in the Tool-room

Better tools are produced with the new system, because the information and sketches furnished to the toolmakers must be complete and accurate, and the limits must be maintained in order that the tools shall pass inspection. The workmanship must be good or else the toolmaker will lose time in correcting defects and may thus lose his bonus. If a man cannot meet the time allowance for a job, the matter is brought to the attention of the supervisor, who then looks into the conditions to determine whether the man is adapted for the particular work in which he is engaged.

Under the former system of payment, the true cost of a tool could not always be determined because of the ease with which the labor performed could be charged to another tool. Now, however, the records are so controlled that each tool is charged only with the labor and material involved in making it.

Routing of Drawings to Facilitate the Operation of the System

When a tool is required, detail sketches are made, showing finish, dimensions, and tolerances, as well as a bill of materials. A requisition issued by the department requiring the tool is attached to the sketches, which are then delivered to the tool-room.

Before the actual work is started, a definite procedure is followed: First, the sketches are segregated and routed to the different group leaders in the tool-room, according to which group can best handle the assembly of a particular class of work. For instance, one group handles only jigs and fixtures, while another group specializes on dies, molds, and gages. Second, the sketches are sent to the production clerk, who orders all the material specified. Third, the order, together with the sketches, is passed to the time study man who thoroughly analyzes the conditions under which the tool must be made, and routes the various parts to the proper machines for the required operations.

Time Study Sheet for Fitting and Assembling

Dwg. No.	Tool	Tool No.	Scr.	Date

Oper. No.	Operation	Item No.	Estimated Time
1	Interpret drawing		
2	Round pin end		

Fig. 2. Form Used for Recording the Time Study Values on Assembly Operations

The job is now ready to have "time values" established. This is done by means of formulas

W⅝ JOB OPERATION SHEET

TOOL NO. 81294E-2 SERIAL NO. 9552 SKETCH NO. 1-0-2759 DATE 4-2-30

ITEM	OPERATION 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1
1										140										
2									410											
9									210											
10									130											
11													70							
12	400						250						60							
13	140						190								225					
14	355														150					
15	550													375						
	1415						440		730	140			130	375	675					

Fig. 3. Form for Recording Time Study Values on Machining Operations

and charts which have been made from time studies of former operations of a similar nature. The formulas are derived by making a study of these operations to make sure that they have been performed in the most economical way, with all unnecessary steps eliminated.

If a machining operation is under consideration, the feeds and speeds most suitable for the work are established. Time studies are made of parts that are to be produced in different sizes, so as to cover the entire size range. From these studies, a curve may be plotted; and, finally, a chart may be made based upon these curves, to simplify their interpretation. In a similar manner, fitting and assembly work is studied and formulas or chart prepared. Forms, as shown in Figs. 2 and 3, are used for recording the estimated time values for each operation.

An Example Illustrating the Time Study Method

As an example of the application of the system outlined, assume that a drill jig for drilling contact cross-bars on oil circuit-breakers, as shown in Fig. 1, is to be made. The sketches furnished for this jig consist of an assembly drawing and detail views giving all necessary dimensions, tolerances, and kind of finish required. The tolerances and the type of finish are important factors in determining the time required to make the tool; close tolerances or fine finishes are not specified unless actually required.

The time study man fills out the form shown in Fig. 2, which is used for recording the time required for the operations in fitting and assembling. The tool number and other identifying information are useful for future reference. On the form are listed thirty-five different operations performed by the bench group of toolmakers, only the first two of which are indicated in Fig. 2. In the case of the jig to be made, twenty-four of these operations are required. Opposite each operation is noted the estimated time needed to perform it. This information is then passed on to the machining time study man.

This man has before him a list of standard machining operations for the tool department, as shown in Fig. 4. The operation numbers in the department are standardized as indicated, so that operation No. 2 always indicates shaping; No. 3, planing, and so on. These numbers are also used in connection with the job operation sheet shown in Fig. 3, where they are listed in a horizontal line across the sheet. On this sheet the time required for performing different operations on the parts for the jig is filled in by the machining time study man, who makes a study of each item to be machined. If, for example, three operations are necessary, as in the case of the item No. 12—shaping, slotting, and grinding (operations 2, 8, and 14, as listed in Fig. 4)—the time required for each is recorded under the operation number.

Standard Operations for Tool Department

Oper. No.	Operation
1	Fitting, including all bench work performed
2	Shaping
3	Planing
4	Turning (Engine Lathe)
5	Turning (Bench Lathe)
6	Turning (Vertical Boring Mill)
7	Milling
8	Slotting
9	Horizontal Boring Mill
10	Vertical Boring (Profilers)
11	Drilling (Radial Drill Press)
12	Heat-treating
13	Grinding (Blanchard and P & W Grinders)
14	Grinding (Diamond Grinders)
15	Grinding (B & S Surface Grinders)
16	Grinding (Universal Grinders)
17	Grinding (Bench Grinders)
18	Grinding (Cincinnati and Ohio Grinders)

Fig. 4. List Identifying the Standardized Operation Numbers Used in the Bonus System

TOOL: 81294 - E-2

NEW TOOL REQUISITION

DELIVER TO TOOL ROOM: K-60

YEARLY ACTIVITY:

DATE WANTED: 4/2 DATE PROMISED:

CHARGE: 3-74 E 340

DATE WRITTEN: 1-30-30

DWG.: 783969 SUB.: ITEM: 1

MADE IN: USED IN:

ESTIMATED COST:

SERIAL:

TOOL SKETCH NUMBER: 1-A-2759

INSPECTORS GAUGE: YES NO

DATE COMPLETED:

TITLE OF APPARATUS: B-20-A Cir. Bkr. SUPT: TOOL SUPV.: TOOL RECORD:

DESCRIPTION OF TOOL: Drill Jig INSPECTOR:

LIST OF DRAWINGS: Ch. 49

OPER. NO.	MFG. OPERATION	SET UP + RUNNING TIME	CHECK NO	DATE	MACHINE ROUTE
1	Fitting, L.O. & Drill	22.85			Bench
2	Shape 12, 13, 14 & 15	14.15			Shaper

Fig. 5. Tool Requisition, Itemizing the Different Operations and the Time Allowed

When the time values for all the parts to be machined have been established, the values under each operation number are added to obtain the total or master values. These final values are then given to the operator in the form of a requisition, as shown in Fig. 5. General information is given on the upper part of this sheet, while the lower part gives the operation numbers, the types of operations, and the time values. The parts requiring shaping (operation No. 2 in Fig. 3) are the items 12, 13, 14, and 15. These numbers appear on the requisition in Fig. 5 opposite Operation No. 2, indicating to the shaper operator that these parts have to be machined by him. In order to make the requisition complete, the total time values for the fitting and assembling, designated as Operation No. 1, are also incorporated.

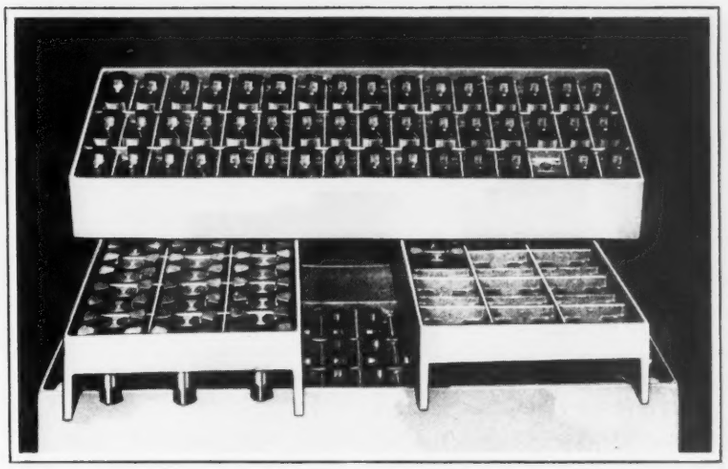
* * *

COMPOSITION AND SYMBOLS FOR CHROME-NICKEL STEEL

Fifty-one steel producers licensed by the Krupp Nirosta Co. (2638 New York Central Building, New York City) have agreed to standardize the specification symbols for chrome-nickel steels produced within certain analysis ranges. The symbols adopted and the compositions of the steels to which they apply are given in the accompanying table.

* * *

Finding horses too slow and tractors too expensive, a farmer of Stony Point, Ontario, solved his difficulty by hitching his plows, harrows, and other agricultural implements to an old Reo passenger car that had traveled more than 150,000 miles. The power plant in an automobile is useful for other purposes than transportation.



Aluminum Work Racks that Have the Advantage of being both Strong and Light

ALUMINUM CASTINGS HAVE ADVANTAGES AS WORK-HOLDING RACKS

Most of the parts that make up the hydraulic shock absorbers produced by the Spicer Mfg. Co., Toledo, Ohio, are machined to unusually close limits, because it is required that the assembled units be absolutely leak-proof and, at the same time, work freely. To protect the surfaces of the parts, it has been found desirable to provide racks in which the parts are kept separate from each other as they are passed to the different machines for the successive operations.

The racks used are made of aluminum castings; typical examples are shown in the accompanying illustration. These racks have been found highly satisfactory, as they combine strength with lightness. In the course of two years' use, only one rack has been broken, and this was caused by an electric truck colliding with it. Racks of the design illustrated weigh only about 4 1/2 pounds, and can be easily handled; they will accommodate forty-eight parts.

Standardized Symbols and Composition of Nirosta Steel

The Base Symbol for Austenitic Chrome-nickel Alloys in the Corrosion Resistant Field is KA2
The Base Symbol for Austenitic Chrome-nickel Alloys in the Heat Resistant Field is KNC

Symbols and Compositions for Wrought Material

Symbol*	Carbon, Per Cent	Manganese, Per Cent, Max.	Sulphur and Phosphorus, Per Cent, Max.	Silicon, Per Cent, Max.	Chromium, Per Cent	Nickel, Per Cent	Molybdenum, Per Cent
KA2	0.16 max.	0.6	0.03	0.75	16.5—20.0	7.0—10.5	.....
KA2–S	0.07 max.	0.6	0.03	0.75	16.5—20.0	7.0—10.5	.....
KA2–H	over 0.16	0.6	0.03	0.75	16.5—20.0	7.0—10.5	.....
KA2–Mo	0.16 max.	0.6	0.03	0.75	18.0—22.0	7.0—10.5	2.0—4.0
KA2–SMo	0.07 max.	0.6	0.03	0.75	18.0—22.0	7.0—10.5	2.0—4.0
KA2–HMo	over 0.16	0.6	0.03	0.75	18.0—22.0	7.0—10.5	2.0—4.0

*The same symbols are used for cast material where the maximum limit for silicon is higher.

The symbol for wrought and cast material is KNC—3, the composition of which is: Carbon, 0.20 per cent maximum; manganese, 0.7 per cent maximum; sulphur and phosphorus 0.03 per cent maximum; silicon, 2.0 per cent maximum; chromium, 23.0 to 27.0 per cent; and nickel, 17.0 to 21.0 per cent.

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

IT is rather surprising to note from the comment on page 345 of January MACHINERY that some school authorities believe that it is good economy to buy inferior equipment for their manual training and trade schools.

In view of what has been said, I think it might be well to call attention to a city that follows a practice diametrically opposite the one described. The city of Milwaukee recently bought for its vocational schools a quantity of machinery equipment. The very best equipment on the market was bought, exactly as specified by the practical men in charge of the training. The school authorities had to pay more than they would have had to do had they tried to obtain low bids irrespective of quality, but the Milwaukee schools were willing to pay whatever was necessary to obtain the best quality of equipment for the training of the boys of that city.

This is a matter of importance to shop executives. Young men cannot be properly trained to become skilled mechanics with poor equipment.

OBSERVER

IS PAYING FOR SUGGESTIONS PROFITABLE?

One company saved over $54,000 the first year it paid its employes for suggestions. In this plant, locked boxes are placed near the time-clocks in every department to receive suggestions. Near these boxes are slips of printed paper with spaces on the front side for writing out or describing the suggestion. If necessary, a sketch or rough drawing can be made on the reverse side of the paper.

The papers are numbered and there is a detachable stub bearing a corresponding number which is kept by the man making the suggestion. With this system, the committee that investigates the suggestions does not know who has made them, and there is no chance to play favorites. The committee is made up of one of the engineers, the chief tool designer, the chief inspector, the head time-study man, and the plant manager's assistant. This committee meets once a week to consider suggestions.

There are two plans of payment, the first being a flat rate of $5 for each suggestion of merit that may not necessarily show a saving on the company's books, such as the suggestion that leather belt lacing be used in place of metal hooks for a belt which is in such a position that it is liable to catch and badly injure an employe.

The other plan of payment is used for suggestions regarding the design of tools or devices for saving labor or for plans of handling the work in a more efficient manner. The payment for such suggestions is based upon the amount that the company will save in one year, the man being paid 10 per cent of the amount saved.

Winning suggestions, as determined by the committee, are posted by their numbers on the bulletin boards throughout the shop, and the men holding the stubs of the tickets bearing these numbers present them to the employment manager and receive payment.

The first year this system was in operation, approximately $4650 was paid out for suggestions which resulted in a saving to the company of approximately $54,380. In one case, an employe was paid $789 for a single suggestion.

CHARLES R. WHITEHOUSE

WHEN IN DOUBT, ASK QUESTIONS

The chief executive of a large manufacturing organization recently said that if no one in his organization, including himself, made mistakes, he could operate his plant four days a week and make profits. It being thus admitted that it is human to make mistakes, the man who asks questions when uncertain, and who calls attention to matters where doubt exists, is a good man to have around the shop. The man who asks questions is thinking about his job, while the man who simply carries out orders is leaving the thinking to somebody else. An organization is only as successful as its component parts; hence the more men that think—that is, that ask questions—the better. GEORGE H. GUNN

AN INVENTORY OF MEN

The shop executive is in the habit of taking an inventory of his materials, but how often does he take an inventory of his men with a view to discovering their possibilities? In taking such an inventory, every man should be considered in connection with his possibilities for progress and leadership. Men who think are usually men who will go ahead. If an honest inventory shows that there are no assets in this direction, steps should be taken at once to acquire them; but if future foremen and superintendents can be developed by sufficient training, from the men already employed, that is the thing to do. If there is a man that is able to handle almost any job in the department, that is the man to encourage and develop. Such a man may be called a key man.

An inventory of men may reveal that there is only one man ready for promotion and that if he is promoted, there is no other key man coming along. This means that it is necessary constantly to look ahead, in order to be sure that there are a sufficient number of promising men being trained. Men of this type should be assigned to as many different jobs as possible, so as to become familiar with all phases of the work in the plant. Some companies give such men an opportunity to visit other plants as well, in order to broaden their outlook.

MARIN PHILLIPS

WHY THE JOBBING SHOP IS UNPROFITABLE

In our telephone directory, this advertisement appears: "Smith and Brown, Designers and Builders of Labor-saving Machinery, Tools, Dies, and Metal Stampings. Electrical and Mechanical Inventions Developed and Manufactured. Our Charges $1.15 Per Hour. Work Guaranteed." Obviously, the advertisers are very skillful persons who can point with pride to many successful jobs which they have completed with tools in their own hands; but how can they possibly expect a purchasing agent who knows his business to buy from them when everyone acquainted with the machinery business knows that "it cannot be done"?

Imagine, $1.15 an hour for the product of a modern machine shop supplying skillful service of the highest grade, requiring the ability of the industry's best mechanics—the highest paid group of mechanics in the machinery field—and using good (for they must be good for work of that kind) modern machine tools.

A business capable of rendering such service is entitled to a fair return for the labor of those who keep it going. Is there no way in which those men in the industry who do not recognize the value of the services that they render could be enlightened, so that they would ask for a fair compensation for their own work and cease to demoralize the industry in which they are engaged?

RAYMOND H. DAUTERICH

SHOULD MACHINE TOOLS BE USED UNTIL WORN OUT?

When a plant is already established and in operation, there are usually three reasons for the purchase of new machine tools: First, to obtain a higher quality of product; second, to increase production rates in order to obtain larger output or reduced costs, or both; and, third, to replace worn-out equipment. The purchase of machines to replace worn-out equipment should be rare in progressive shops. Machines of the latest design generally produce a better quality of product at a lower cost than equipment of older types and, hence, it almost always becomes necessary in up-to-date plants to replace machines because they are obsolescent rather than because they are worn out.

OBSERVER

TAKING CHARGE OF A DEPARTMENT

In assuming charge as foreman or supervisor of a department in a plant in which the new executive has not been previously at work, how should he proceed? This question was asked of a man with broad experience in the manufacturing industries. His ideas on the subject are, briefly, as follows: The new foreman should ask for a list of what is expected of him and his department. He should ascertain definitely who is his immediate superior and to whom he is expected to report. Next, he should arrange to have someone take him around his department to make him acquainted with the men that are to work for him.

In becoming acquainted with them, he should endeavor to pronounce their names clearly and distinctly. Nobody likes to have his name mispronounced. He should endeavor to convey to the men of his department, as he makes the acqaintance of each, that he will do his best to get along agreeably with them. He should make them feel that he will be a supervisor, not a "boss."

Now, having spoken to everyone in the department, he should ask to have the best qualified man available describe the system in effect for operating the department; the methods of handling tools, materials, and supplies; and the procedure that the previous foreman followed in running the department. In fact, he should obtain, in this way, all the information that he will need to supervise the work properly. Then, gradually, he should spend some time with each man in the department, having him explain the work that he is doing. This will tend to create goodwill, and at the same time will enable the new foreman to become acquainted with his men and learn something of their individual traits.

JOHN A. HONEGGER

EXPERIENCE FOR GRADUATE APPRENTICES

How shall the graduate apprentice obtain that valuable experience that is acquired only by working in some shop other than the one in which he has been trained, without leaving the firm for good? It seems to the writer that it would be possible to arrange to have an apprentice, after he has served his time, spend, say, six months or longer in some other shop to gain additional experience, with the understanding that he is to return to the "home" shop at the end of this period. Such an arrangement might be made possible by employers interchanging their graduate apprentices. This cooperative arrangement should work to the advantage of all concerned.

In this connection, the question might arise as to what guarantee there would be that the apprentice would not be lost to his original employer. To meet this condition, it would be possible to hold back a certain part of the compensation during the apprenticeship, to be paid by the employer after certain stipulations have been fulfilled. Failure to live up to this contract would result in forfeiting this sum.

JOHN HOMEWOOD

Machining Link Rods for Aircraft Engines

Special Milling, Drilling and Boring Equipment Used in Machining Link Rods for Wasp and Hornet Engines

By FREEMAN C. DUSTON

PREVIOUS articles in September and December MACHINERY, pages 1 and 273, described the practice of the Pratt & Whitney Aircraft Co., Hartford, Conn., in machining, testing, and assembling some of the important parts for Wasp and Hornet engines. In the present article, some of the machining operations on the link rods are described. Eight of these link rods, one of which is shown at *C*, Fig. 4, are assembled on the master rod illustrated and described in the previous articles. The particular operations described here illustrate several interesting applications of specially equipped machine tools.

Facing Link Rod Ends on Hydraulically Operated Milling Machine

In Fig. 1 is shown a milling machine equipped with two circular work-holding tables *A* and *B*. These tables are mounted on a hydraulically operated slide *C*. Each of the circular tables has two work-holding positions of similar design. This arrangement permits two link rods to be loaded on each table while the cutters *D* straddle-mill two faces on the small ends of two rods and the cutters *E* straddle-mill the two faces on the large ends of two other rods.

The hydraulic control advances table *C* to the end of the feeding stroke, and then automatically backs it away until the work clears the cutters. Next, the two circular tables are indexed automatically and the same milling operations repeated on the rods that have been indexed into position. While the table is being fed forward, the milled pieces are removed from the fixtures, the rods milled by cutters *D* being placed on table *B*, as shown at *G*, while two new rods are loaded on table *A*. Thus the two rods removed from table *B* at each operation have both of their ends straddle-milled to size.

Drilling and Reaming Bushing Holes

In Fig. 3 is shown a drilling machine equipped with a special head and indexing fixture for drilling and reaming the ends of the link rods milled in the set-up shown in Fig. 1. The fixture has work-holding clamps on all four sides, and is indexed one-fourth revolution after the tools have

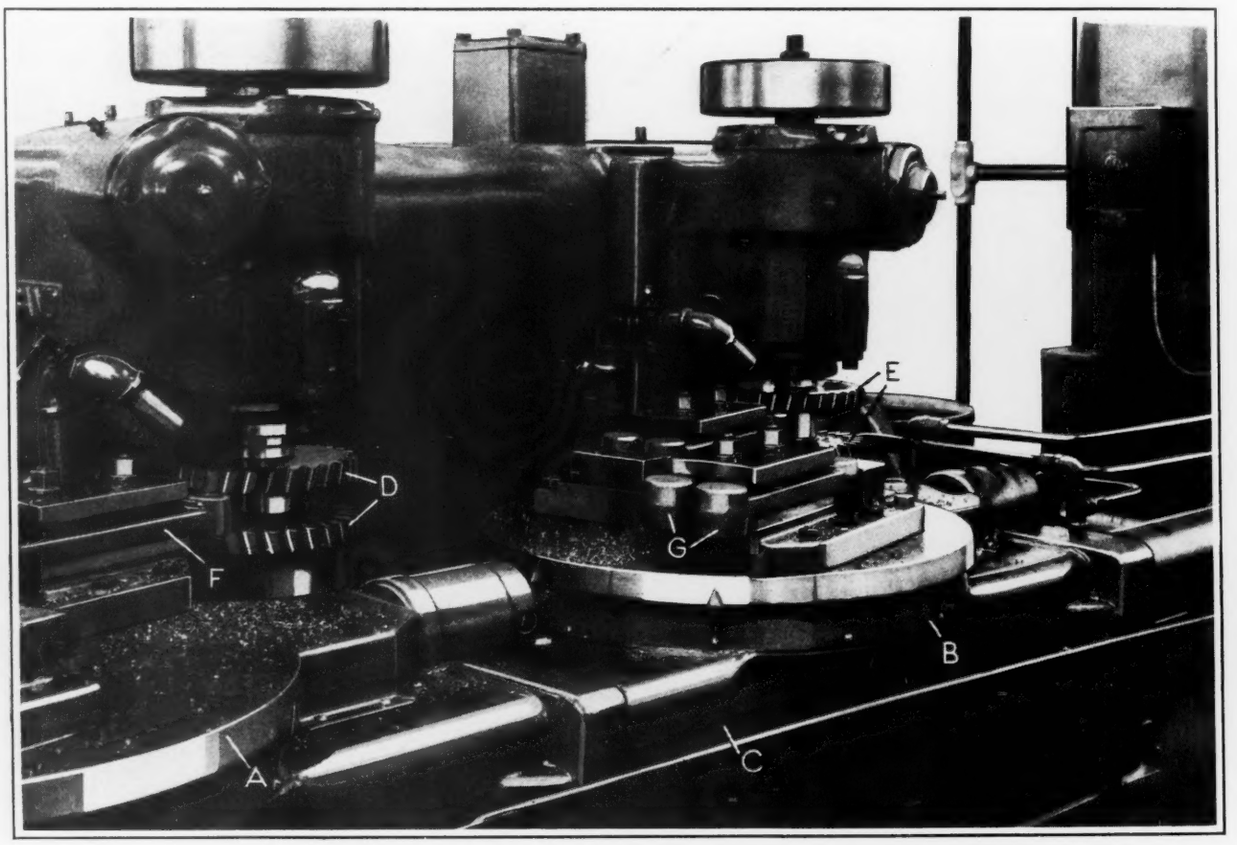


Fig. 1. Milling Machine Equipped with Two Hydraulically Operated Indexing Tables for Straddle-milling the Ends of Link Rods for Wasp Engines

been withdrawn so that they clear the work and the fixture. A drilled and reamed rod *A* is removed from the fixture at the front position and replaced with an undrilled rod after each indexing movement.

The fixture is indexed to the left, so that the drills *B* and *C* drill the small and large ends of the rod in the first position. The next indexing movement carries it to the rear position, where drill *D* enlarges the hole previously produced by drill *C*. In the third position, the reamers held in spindles *E* and *F* ream the holes drilled at the two preceding positions. The fourth indexing movement brings the rod to the loading position, where it is removed and replaced by an undrilled rod ready for the next cycle of operations.

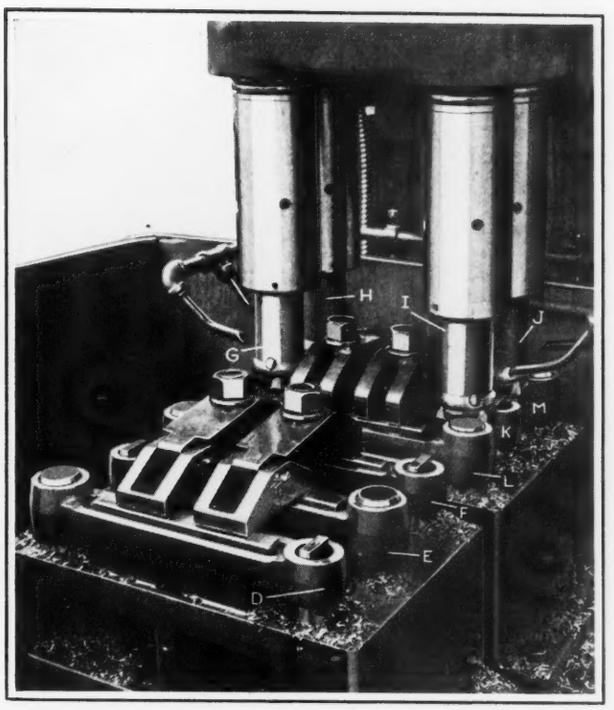


Fig. 2. Machining Two Radius Surfaces on the Link Rods

Machining Radius Surfaces on a Multiple-spindle Drilling Machine

In Fig. 2 is illustrated an interesting and effective set-up for machining the surfaces indicated at *A* and *B* on the partly finished link rod *C*, Fig. 4. Three rods *D*, *E*, and *F*, Fig. 2, are clamped at one time in one of the two work-holding positions. While these rods are being clamped in place, the four inserted-tooth cutters *G*, *H*, *I*, and *J* machine all four radius surfaces of rod *K* and two radius surfaces on one side of each of the two rods *L* and *M*.

When the cutters have been withdrawn after the feeding movement, the fixture is indexed to bring the pieces *D*, *E*, and *F* into position under the inserted-tooth cutters. The rods *L* and *M*, which

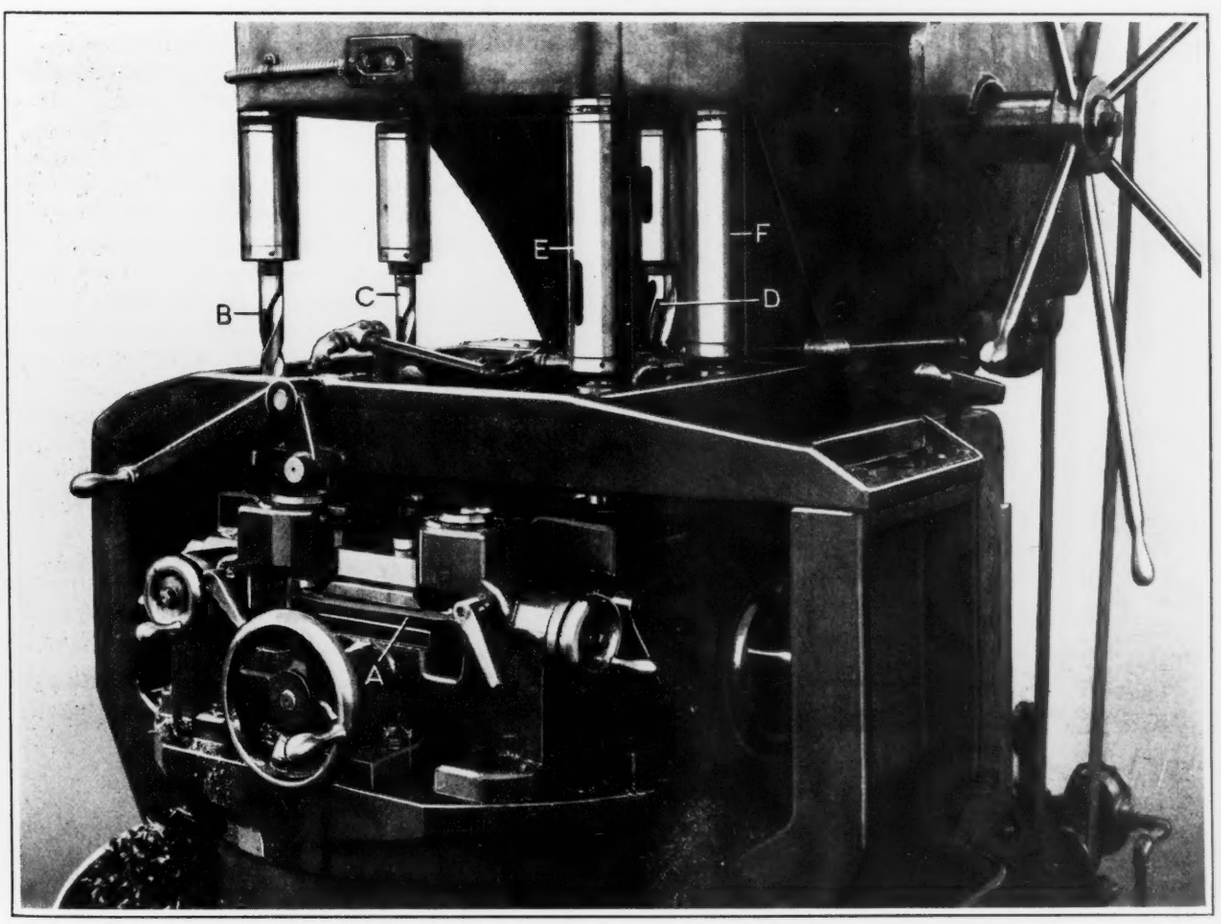


Fig. 3. Machine with Special Head and Indexing Fixture for Drilling and Reaming Bushing Holes in Link Rods

have been machined on one side, are then reversed on their locating plugs and a new rod placed between them. Thus three rods are completed at every other operation. At each alternate operation one rod is completed and two rods half completed, this being equivalent to finishing two rods per operation.

Diamond-boring Holes in Bronze Bearing Bushings

In Fig. 4 is shown a diamond-boring machine equipped for boring out the bronze bearing bushings pressed into the holes in the ends of the link rods. The two bushings are bored simultaneously by diamonds mounted in the spindles at *D*. Although the spindles run at very high speeds, the diamonds have an exceptionally long life, averaging about 3000 holes before they need to be replaced. This feature greatly facilitates holding the holes to size within the accurate limits required. The rod *C* is placed on locating pins at *E*, and the bar *F* clamps the work in place on the downward stroke. The pins recede as the diamond-boring tool advances through the work. During the boring operation, the hinged cover *G* of the sheet-metal guard is closed to retain the cutting compound which is thrown outward by the action of the high-speed spindles.

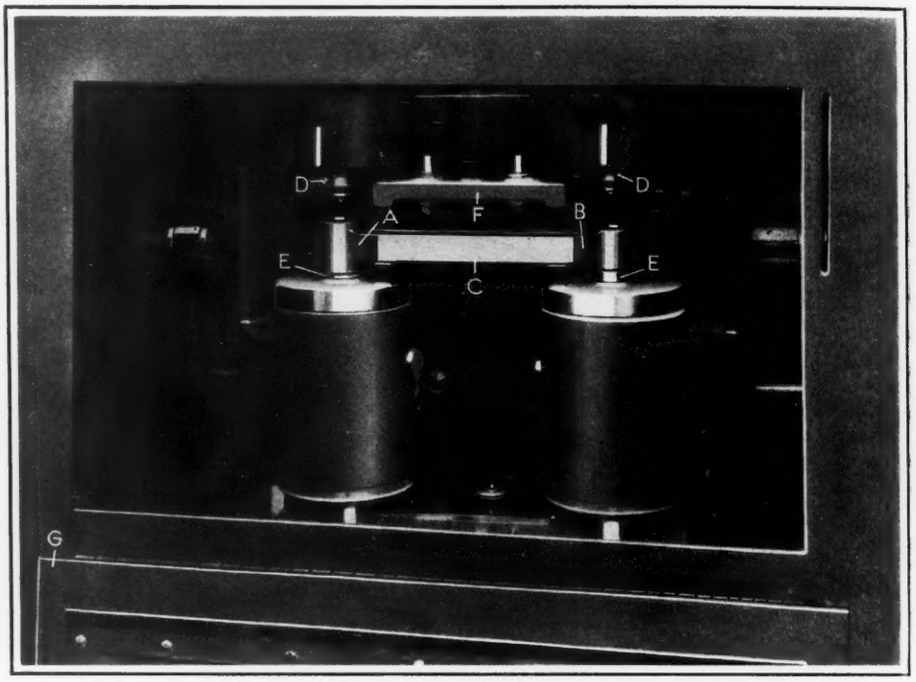


Fig. 4. Diamond Boring Machine Set-up for Finish-boring the Bronze Bushings Pressed into the Holes at the Ends of the Link Rod C

FACEPLATE FIXTURE FOR BORING ECCENTRIC BRACKET

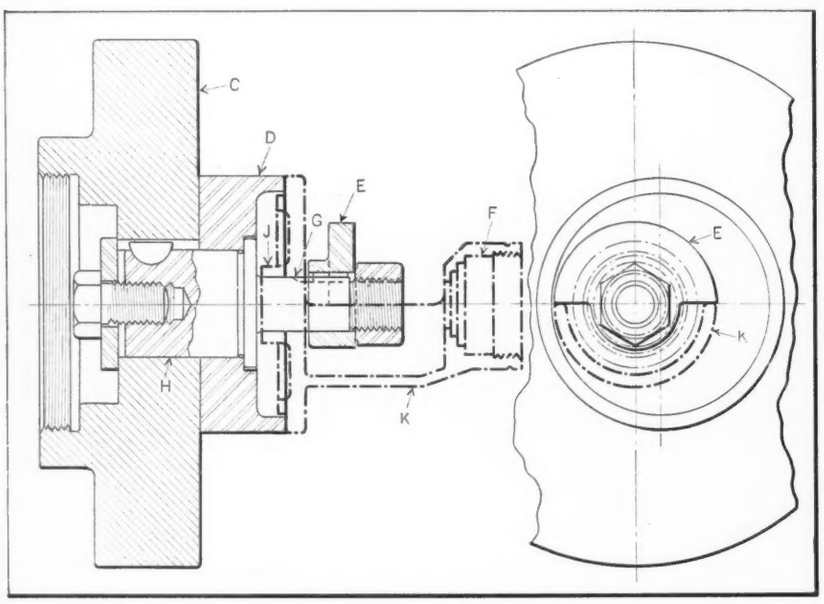
By GEORGE L. PYRITZ, Indianapolis, Ind.

In the accompanying illustration is shown a faceplate fixture used for boring an eccentric bearing bracket for an automobile water pump. In this bracket is assembled an impeller shaft, mounted in a ball bearing at *F* and in a plain bearing at *J*. The combined driver and locator *E* is a slip fit on the arbor *G* and acts against the edge of the connecting web *K* of the bracket. The driver is keyed to the arbor, and the arbor, in turn, is keyed to the faceplate, thus insuring a positive drive as well as locating the casting on the fixture correctly.

Referring to the construction of the fixture, *C* is a cast-iron faceplate screwed on the spindle nose of the lathe. The shank *H* of the arbor is a press fit in the faceplate and work-plate *D*, and is further secured by a cap-screw and washer at the rear of the fixture. The work is clamped back against the plate *D* by means of a nut screwed on the end of the arbor.

* * *

One of the numerous ways in which the automobile industry has influenced shop operation is seen in the use of electrically operated automobile horns at various points throughout a plant in place of the old-time factory whistle.



Faceplate Fixture in which the Work is Driven and Located by the Same Member

Suggestions on Cold-swaging Die Design

Extreme Accuracy, Smooth Finish, and a Hard Surface are Characteristic Qualities of Parts Produced in Correctly Made Cold-swaging Dies

By C. W. HINMAN

COLD-SWAGED parts can be produced rapidly within limits of a ten-thousandth of an inch by the use of proper equipment. Moreover an excellent appearance and a very hard surface can be obtained, because of the high pressure necessary for cold-swaging. Success in this work depends a great deal upon the selection of the metal for the part to be formed. A very mild steel, thoroughly annealed, or a deep drawing steel may be used. Soft yellow brass, soft copper, zinc, or any other highly malleable metals are also suitable, depending, of course, upon the function of the finished part in its assembly.

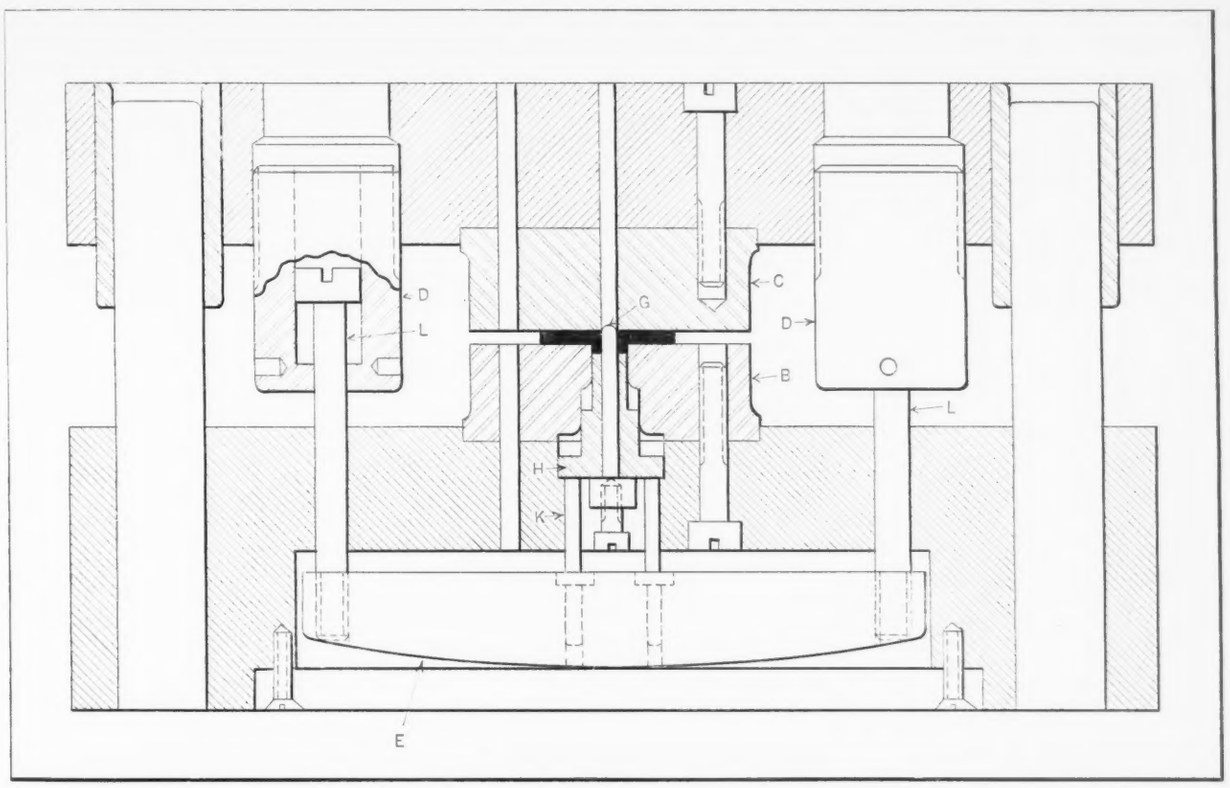


Fig. 1. Cold-swaging Die of Typical Design for Making Part Shown at B, Fig. 2

Work is Often Facilitated by Making Trial Dies

It is sometimes advisable to make a cheap experimental die-block first, and try out the job in the swaging press, in order to ascertain whether it would be practicable to make a swaging punch and die. For this purpose, only a simple die-block is necessary, as the swaged sample can be easily removed from the block with a drift pin. This method determines not only whether the part can be embossed satisfactorily in all its sections, but also what size and shape are required for the blank.

The blanks can either be made on a screw machine or punched from sheet stock. Generally, the machined blank is preferable, as it is free from crystallized edges such as are found on a punched blank, which might cause trouble by splitting in the swaging operation. The final die should be of rugged construction, the previous experimental work being the designer's chief guide on this point.

In Fig. 1 is shown the design of a typical swaging die. The blank and the finished part made in this die are shown at *A* and *B*, respectively, in Fig. 2. Punch *C*, Fig. 1, is fastened by screws in the punch-holder, and die *B* in the die-shoe. In operation, the blank is located in the die by placing its center hole over the pin *G*. When the ram descends, the blank is flattened between members *B* and *C*, causing the metal to flow around pin *G* and downward into the opening around the pin, thus forming a hub at the center of the work.

There is also a flowing action of the metal which increases the diameter of the blank. As the metal flows downward around the pin *G*, the shedder *H* is forced downward until the bottom of the shedder rests in the die-shoe as indicated. It will be seen that the top of the shedder produces a flat face on the finished boss.

As the punch ascends, the heads of the two screws *L* come in contact with the bottoms of the cups *D* in which the screws are a sliding fit. Upon the continued ascent of the punch, the screws *L* raise the ejector-bar *E*, which, in turn, raises the shedder *H* by means of the pins *K*, thus stripping the formed work from die-block *B* and pin *G*. The cups *D* are screwed in the punch-holder and their height can be adjusted to correspond with the stroke of the press.

Shapes Adapted to the Cold-swaging Process

It is sometimes necessary to form a boss on both sides of the work. In this case, another ejector-bar may be built into the punch-holder at a convenient angle to the one in the die-shoe. The second bar may be actuated in the same manner as the one described, although it must be set to operate immediately before or after bar *E* has functioned.

In Fig. 2 are illustrated six other parts used in the construction of clocks and registering devices to which the type of swaging die described in the foregoing might be applied.

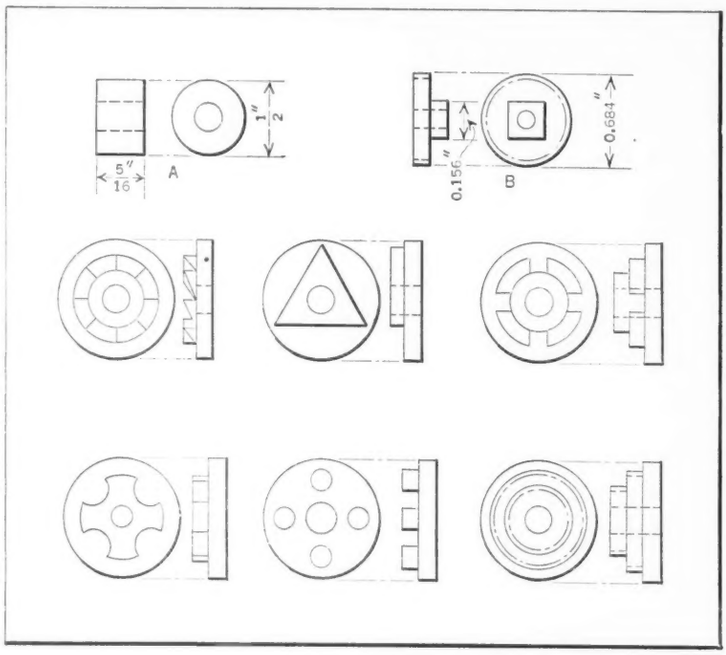


Fig. 2. Examples of Work for which the Cold-swaging Process is Particularly Adapted

Points to Consider in Designing Die

The design of the die should be such that the heaviest part of the swaging pressure is located at the center of the press ram. Another important point that should not be overlooked is that all the hardened parts of the die that come in contact with the work must be ground, lapped, and polished perfectly smooth; otherwise, it will be difficult to strip or eject the finished work from the die.

To further facilitate the operation of the die, a good lubricant may be used. After the blanks have been swaged, the irregular contour is trimmed off in another die. Special dies are employed for cutting ratchet teeth, gear teeth, or other contours after the swaging operation has been completed.

* * *

Letters and figures made of metal having a low fusing point sometimes collapse as a result of overheating when an attempt is made to solder them to metal patterns. This trouble can be remedied by applying a heavy plating of nickel to the letters and figures before soldering.

USING A HANDBOOK TO BEST ADVANTAGE

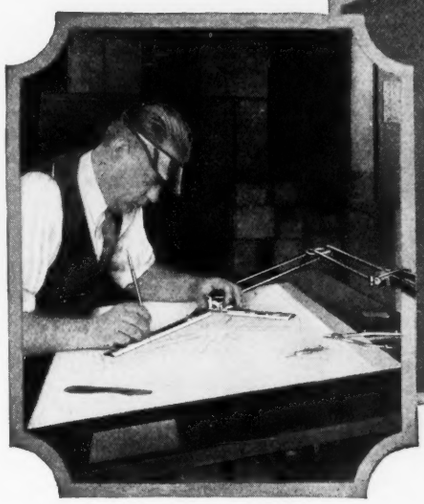
To get full benefit out of a mechanical handbook, it is necessary to post one's self thoroughly on its contents. Much of the information available in handbooks is not made use of because the owner of the handbook does not realize that the information is available. It is therefore advisable from time to time to go through the handbook, page by page, so as to become thoroughly familiar with the numerous tables it contains and the subjects that it deals with. No matter how complete the index is, there are times when the handbook user will not think of the word that would give the required information; and yet the data required is available. The man who has actually gone through his handbook a few times, looking over its contents, will be better able to make use of the information that it contains when occasion arises.

There are many problems that can be solved by means of the formulas in mechanical handbooks for which at first sight it might seem that no formula is given. MACHINERY recently had an inquiry for a method of determining how large a roll belting of a given length and thickness would make, when rolled up for storage or shipment. Our correspondent had been unable to find a formula in any handbook that would enable him to make this calculation; yet by means of the formulas given for arithmetical progression in MACHINERY'S HANDBOOK, the required answer could be found quickly.

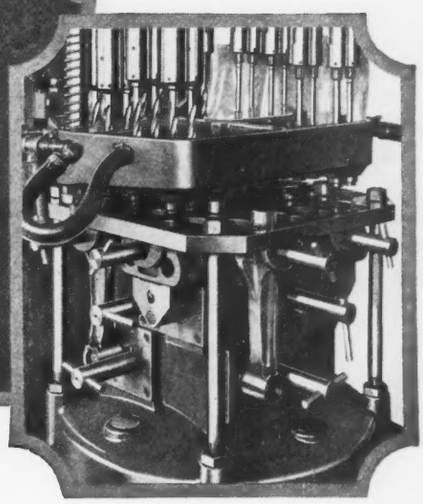
In a similar way, the information given in a mechanical handbook will answer hundreds of questions for which it apparently contains no formulas; but it is necessary for the user to know what information the handbook contains and how it can be applied to different types of problems.

* * *

The color analyzer announced some time ago as a laboratory development by the General Electric Co., Schenectady, N. Y., has now been placed on the market. This is a photo-electric device which automatically draws a color curve of a sample for permanent record. One of the most immediate fields of usefulness for this recording color analyzer is for examining the shades of different dyes, printing inks, paints, and paper.



Design of Tools and Fixtures



QUICK-ACTING CHUCKING FIXTURE

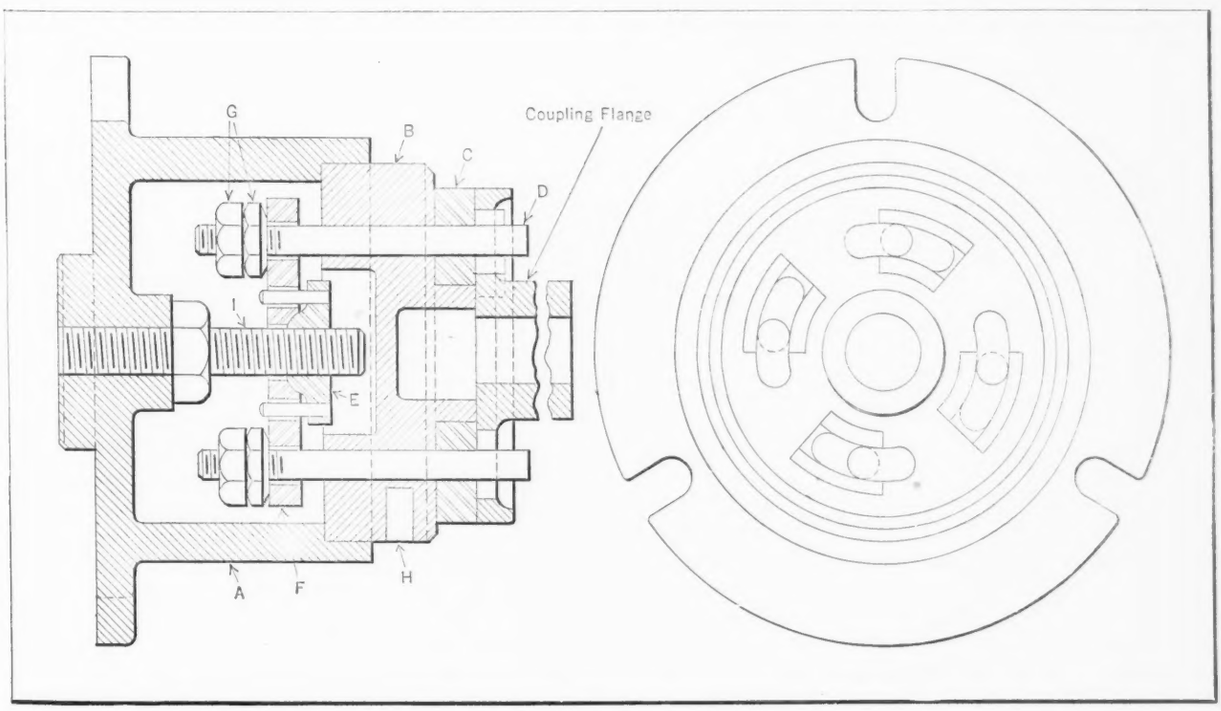
By CHARLES J. RAYMAN, Tool Designer,
Cherry-Burrell Corporation, Cedar Rapids, Ia.

The chucking fixture illustrated was designed for machining a coupling flange in a turret lathe. It enables the outside of the hub, the outside of the flange, and the two faces to be turned, and boring and reaming operations to be performed in one setting. The face of the flange is ground in a previous operation. Only one movement is required for clamping the flange in position.

The fixture consists of a base *A* which is clamped to the faceplate, and is bored at one end to receive the disk *B* on which is turned a projection that is a running fit in the locating ring *C*, the outside diameter of which is slightly smaller than the outside of the flange to provide clearance for the tool. This ring is provided with four lugs that enter the cored holes in the flange, locating the latter in a central position.

Four hook-bolts *D* are provided for clamping the flange against ring *C*. The heads of these bolts, in their clamping position, extend over one edge of each of the cored flange holes and are drawn back against the flange when the disk *B* is rotated in a clockwise direction. This clamping movement is effected by the nut *E* which is pinned loosely to the plate *F* through which the bolts pass.

One side of the nut *E* is of spherical shape and fits into a corresponding depression in the plate *F* to compensate for any irregularities in the thick-



Chucking Fixture in which Work is Clamped by Four Hook-bolts Operated Simultaneously

ness of the flange. Adjustment to suit flanges of different thicknesses may be made by check-nuts *G*.

In operation, the flange is located over the lugs on plate *C*, and the plate is rotated in a clockwise direction until the heads of the bolts are over the edges of the cored holes. A long bar is then inserted in a hole *H* drilled in the side of disk *B*, the bar being used as a lever for rotating the disk. As the disk is rotated in a clockwise direction, the nut *E* turns on the screw *I* and carries all four bolts to the left, clamping the heads tight against the work flange. When the machining operation is started, the pressure of the cut will have a tendency to tighten the grip of the hook-bolts. Incidentally, it has been found that the heaviest cuts failed to dislodge the work from its seat.

In making a fixture of this type, the pitch of the thread on the stud *I* must be such that the work will not be gripped too tight by the hook-bolts, as otherwise the heads will bend and break off. On the other hand, if the threads are too coarse, the vibration caused by the machining operation may loosen the nut enough to allow the bolt heads to come away from the flange. It has been found by experiment that a bolt 1 inch in diameter having six Acme threads per inch is suitable.

FIXTURE FOR BENDING FLAT STOCK EDGEWISE

By A. EYLES, Moston, Manchester, England

In Fig. 2 is shown the lay-out for cutting out brass pieces *A* from sheet brass approximately 3/32 inch thick. Originally these pieces were cut out with ordinary tinner's hand shears. Although the outlines were followed carefully, it was found that the irregular shearing action caused distortion, which resulted in a contour somewhat different from the original lay-out. In order to overcome this difficulty and also to economize in the material required, the sheet stock was cut into strips and the pieces bent to shape by utilizing the simple device shown in Fig. 1.

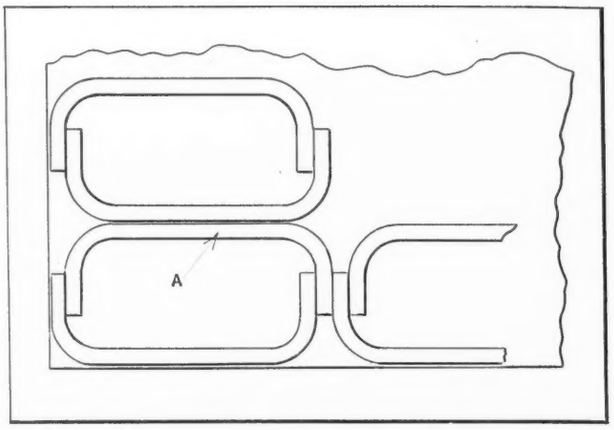


Fig. 2. Lay-out for Cutting Parts A from Sheet Brass

The bending device consists of three pieces of steel plate securely riveted together. The two outside plates are made of 1/8-inch steel. The center plate is also of steel and is 3/32 inch thick. The contour of the center plate is indicated by dotted lines at *D* and corresponds to the inner profile or form of the bend at each end of the part. One end of the strip *B* to be bent is placed in the groove *A*, after which the strip is worked or bent to the required form *C* by repeated blows from a hard wood mallet. After bending one end, the piece is reversed and the opposite end treated in the same manner. The pieces are slightly warped by the bending operation, but they can easily be straightened or flattened with a smooth steel block and a mallet.

By cutting the stock into strips and bending as described, it was possible to obtain 1000 pieces from 84 square feet of brass sheet, whereas 182 square feet of stock was required with the old method of cutting or shearing the pieces to shape.

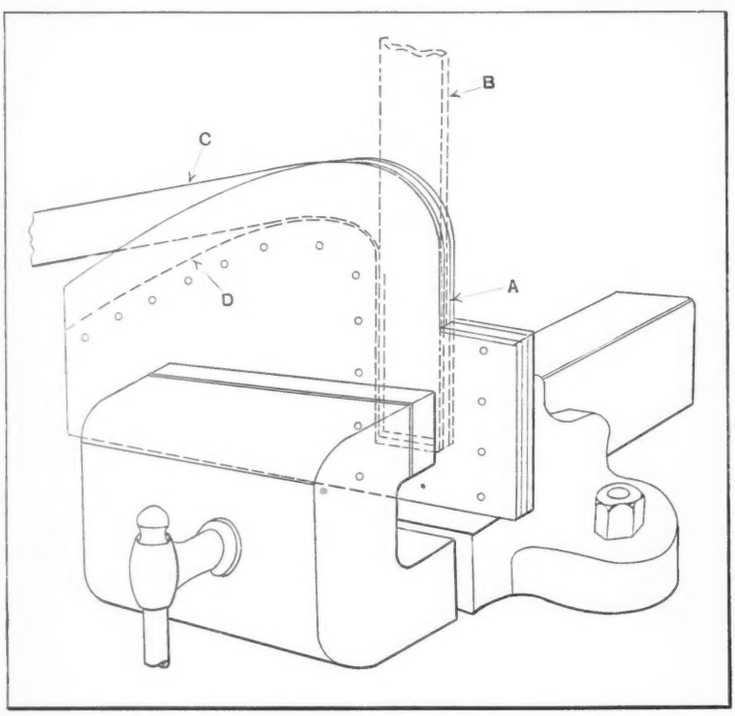


Fig. 1. Fixture for Bending Flat Strips Edgewise

FORMING DIE FOR WATCH PART

By W. E. WHITE, Hamden, Conn.

The die shown in Fig. 2 was designed to form the three bends at *N*, *J*, and *K* in the part shown in Fig. 1. This part is used in the hand-setting mechanism of a lady's watch. The formed blanks must be exactly alike, with the bends accurately positioned in relation to the two pierced holes. During the forming operation, the blank is held firmly between the forming punch *H*, Fig. 2, and the pressure plate *B*, which ejects the blank from the die after the forming operation is completed, so that it can be easily

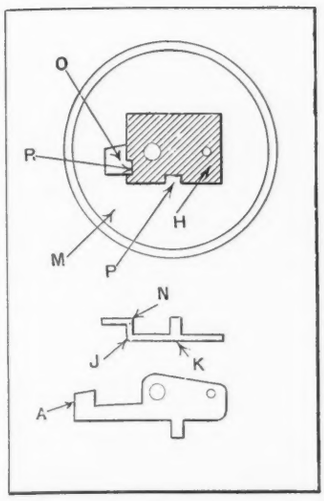


Fig. 1. Section x–x through Punch H, Fig. 2, and Part before and after Bending

removed and another blank inserted in its place.

The die was designed to be used in a foot press. The base *C* is of cast iron, and the punch plate *D* is made of machine steel. Hardened steel studs *E* fit into reamed holes in the base and insure accurate alignment of the upper and lower members of the die. The blank to be formed is placed on the pins *F* in the top of the pressure plate *B*, which is flush with the surface of the die plate *G*.

The descending punch *H*, which is backed up by the heavy spring *I* of square cross-section, forces the blank into the die, forming the bends indicated at *J* and *K*, Fig. 1. The pressure plate *B* is forced down into the die until it strikes the shoulder at *L*. The punch *H* then recoils against the spring *I*, allowing the outer punch *M* to form the angle at *N*, Fig. 1. When the punch is raised, the pressure plate *B*, Fig. 2, ejects the blank from the die.

A recess or slot is milled in the end of punch *M*, as indicated at *O*, Fig. 1. The end *A* of the blank is folded into the recess *O* and thus is prevented from being twisted out of its proper position. Punch *H* also has slots *P* and *R* milled in it, in which the bent-up parts are a close fit. These slots prevent the bent-up portion from twisting during the final bending operation. The edges of the die *G*, Fig. 2, are rounded just enough to prevent cutting the blanks.

A die of this kind is especially well fitted for the accurate forming of sheet-metal parts in which the bent portions are required to be positioned accurately with relation to holes or certain parts of the blank. For this particular job, the holes are used to locate the blank in the die, but if the blank has no pierced holes, it may be located by a gage or nest milled in the top surface of the pressure plate *B*, Fig. 2.

THE ENGINEER'S OWN DATA BOOK

By W. D. BROWNING, Memphis, Tenn.

While the general information on engineering and shop practice that is required by an engineer, machine designer, or draftsman is available in engineering handbooks and reference books, the writer has found it desirable to collect, in a note-book, such information as he comes across during his regular routine work. A note-book of this kind will always be found valuable, and most successful designers and draftsmen have compiled such information and indexed it so that they can find what they need at a moment's notice. The writer has found a great deal of use for information compiled by himself and advises every designer and draftsman to follow this procedure. If the data is of general interest and not of too special application, it might be well to send a copy of it to a mechanical journal to be published for the benefit of other designers and draftsmen.

QUICK-ACTING FIXTURE FOR MILLING REAMER FLUTES

By WALTER WELLS, Moscow, U. S. S. R.

A fixture for milling the flutes in reamers 0.163 inch in diameter and 4 1/4 inches long is shown in Fig. 1. These reamers are of special size, and because of their frailty, provision had to be made for supporting them against the pressure of the fluting cutter. The design of the fixture permits rapid loading, as only one movement is required to release the work.

In the lower view of Fig. 1, the fixture is shown strapped to the machine table. At the left of the cast-iron base *A* is an indexing plate, the shank of which revolves freely in the casting. In the small end of this shank is held a split bushing *B* which serves as a chuck for the reamer.

The cutting end of the reamer is supported by a center which is omitted in the lower view, but is shown in detail above. This center is a sliding fit in the base and has a shoulder at one end which serves as a seat for the coil spring *H*. A short

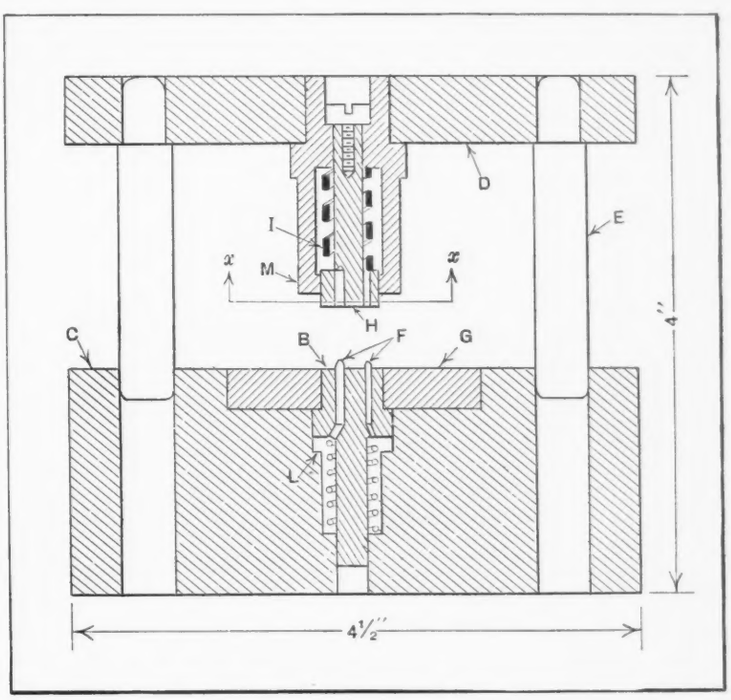


Fig. 2. Die for Bending or Forming Part for Watch

endwise movement is given the center by means of the eccentric pin *C*. This pin turns freely within a bushing *D* which is free to slide vertically in a hole bored in the base. However, the movement of the bushing is limited by the stop *M*, a projection of which slides in a groove cut in the bushing as indicated.

This groove extends only to within 1/16 inch of the bottom of the bushing. Hence, the stop *M* prevents the pin and bushing from being pulled all the way out of the casting. The lower end of the pin engages a clearance hole drilled in the center, and is eccentric to the portion of the pin in the bushing. Thus, when the pin is turned, an endwise motion is imparted to the center.

Only one motion is required to remove the center from the work. The pin *C* is turned and at the same time given an upward movement so that its lower end will clear the outside diameter of the center. At this time, the coil spring automatically forces the center to the right until the stop-pin *E* comes in contact with the base. When a reamer blank is placed in the fixture, the center is pushed to the left and the pin *C* forced downward until its lower end engages the hole in the center, after which the pin is turned until the point of the center has been forced tightly into the center hole of the reamer, as clearly indicated in Fig. 1.

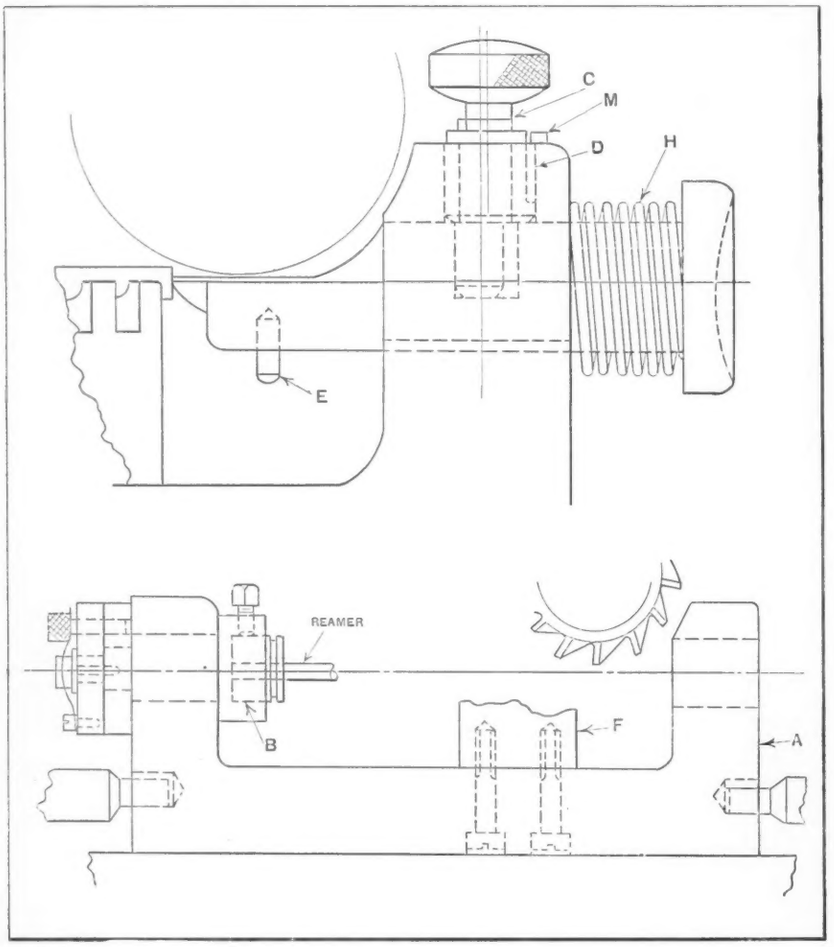


Fig. 1. Reamer-fluting Fixture Designed to Permit Rapid Loading

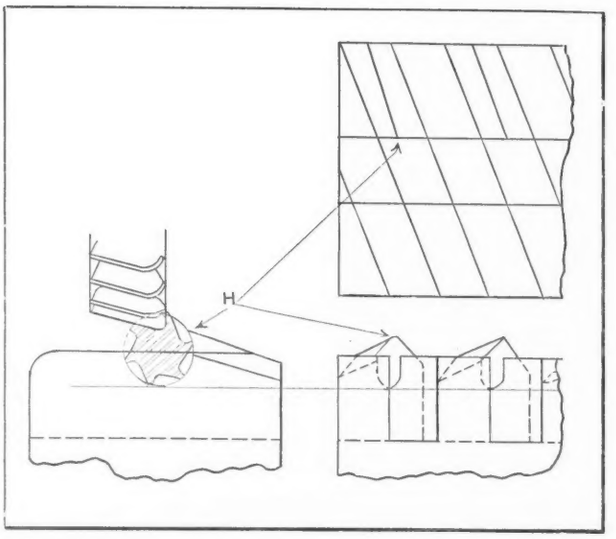


Fig. 2. Detail of Steadyrest for Fixture shown in Fig. 1

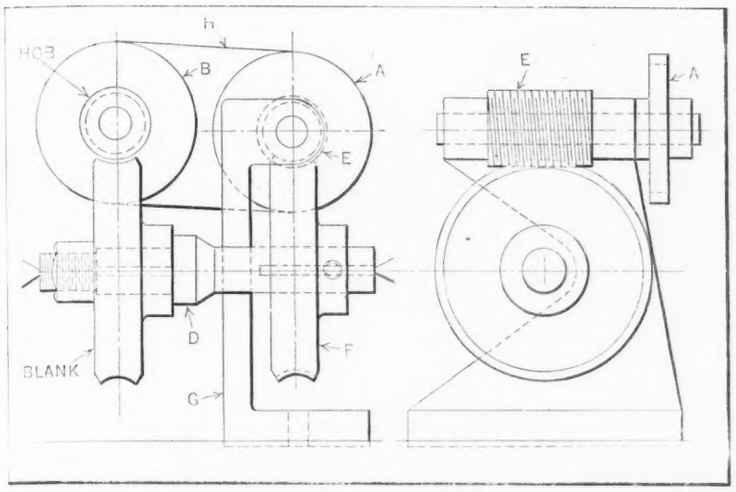
While being milled, the reamer is supported by the steadyrest *F* shown in the lower view. A detailed view of this rest, with the reamer in position, is shown in Fig. 2. To allow sufficient seating area for the reamer, the bearing provided in this rest is made one-half the circumference of the blank. The V-shaped projections at *H* are hardened and serve to remove the burrs resulting from the fluting operation, thus eliminating chip and burr interference between the reamer and the steadyrest.

As the reamer is indexed, the sharp angular edges of these projections remove the chips and shave off any burrs thrown up along the edge of the reamer blade. With this type of steadyrest, it is necessary to clean the grooves and slots only after each reamer has been completely milled. The device described can, of course, be easily modified to adapt it for handling other work of a similar nature.

CHAIN-DRIVEN FIXTURE FOR HOBBING WORM-GEARS

By L. D. SECOY, Lancaster, Ohio

In most fixtures for hobbing worm-gears, the blank is rotated by a master worm and worm-gear through a train of spur gears. In the design shown in the illustration, however, the spur gears have been eliminated and are replaced by a silent chain. This is a more economical construction, and still retains the positive feature of the geared type.



Worm-gear Hobbing Fixture Having a Silent Chain which Rotates the Gear Blank

Referring to the illustration, the master gear *F* is secured to one end of the arbor *D*. The latter is a running fit in a bearing in the fixture base *G*, and is turned down at the left-hand end to receive the blank, which is held securely on the arbor by means of a nut. The arbor can also be moved endwise in the fixture base and is supported between regular milling machine centers.

The master worm *E* is mounted on a shaft which revolves in bearings integral with the base *G*. On one end of this shaft is secured the sprocket *A*. Another sprocket *B* of the same diameter is keyed to the milling machine spindle, and by means of the silent chain *H*, rotary motion is imparted to the master worm and worm-gear. Hence, the hob and blank must rotate at the same speed as the master worm and worm-gear.

To eliminate any slack in the chain, provision is made for moving the master gear along shaft *D* as the center distance between the hob and worm varies. In operation, the blank is placed on the arbor and the table raised to the required tooth depth without the usual preliminary gashing.

DIE FOR PRODUCING EIGHT PARTS SIMULTANEOUSLY

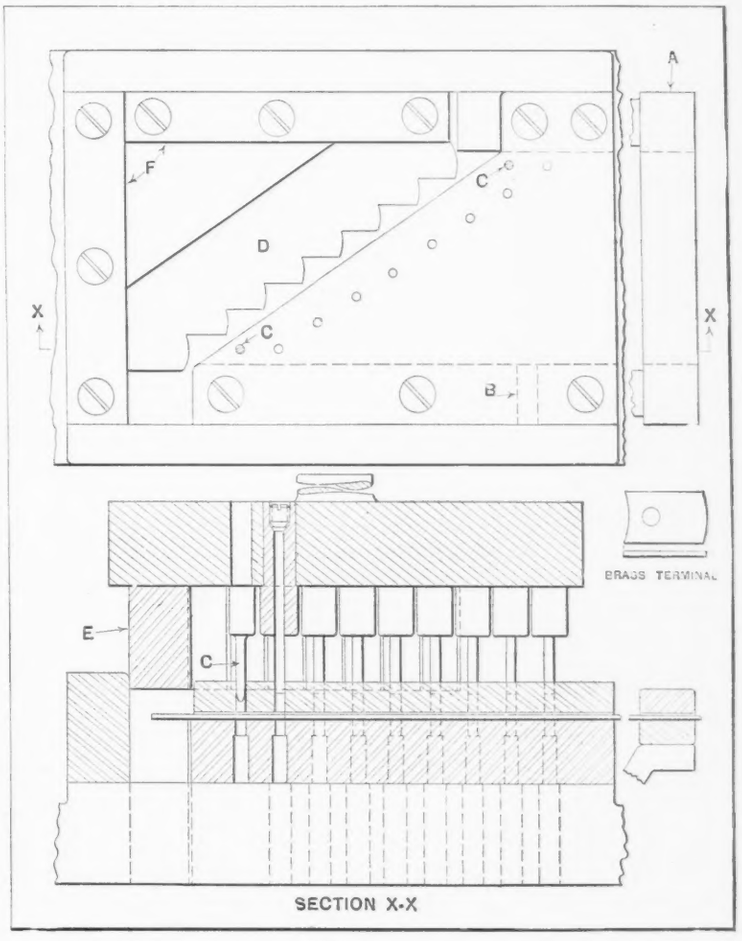
By J. E. FENNO, Bloomfield, N. J.

Eight brass terminal clamps are pierced and blanked simultaneously at one stroke of the press in the die shown in the accompanying illustration. In this operation, the only waste in the strip is that resulting from piercing the small holes. The brass terminal clamp, shown to an enlarged scale at the right of the illustration, is used for clamping a unit in an electric switch.

Referring to the plan view, the strip is passed through an outboard support or guide *A* and along the top of the die until it comes in contact with a stop that fits in the slot *B*. The punch now descends and pierces the first hole. At this point the roll feed is set to carry the stock along the required distance, after which the press is started again. As the punch descends a second time, the two pilots *C* locate the strip for piercing the second hole, and on the third descent of the punch, one blank is made.

The strip continues to feed through the die in this manner until eight blanks are cut at each stroke of the press. As the blanks are severed from the strip, they drop through a hole at *D* and into a container beneath the press table. The blanking punch *E* is backed up by two rectangular pieces *F*, secured to the bolster, which take the thrust from the blanking operation. The economy obtained by the use of a die of this design is obvious, as the loss in scrap is very small and the production high.

It will be noted that the punch extends slightly farther than the two extreme edges of the strip, so that a clean corner will be made on the end blanks if the width of the stock should vary.



Die for Blanking Eight Parts at One Time with Practically No Waste

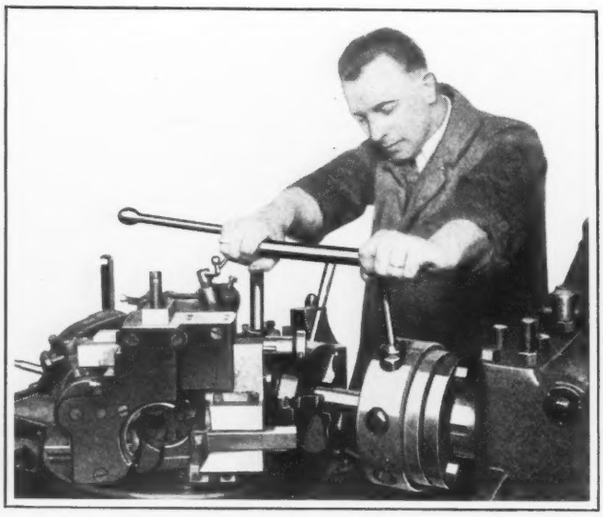


Fig. 1. Securing and Truing up the Bolt Forging in the Spindle Chuck

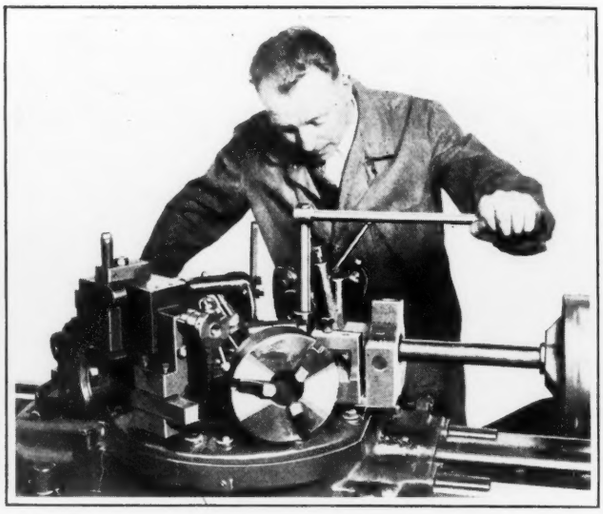


Fig. 2. Facing and Chamfering the Small End of the Locomotive Frame Bolt

Turret Tooling for Locomotive Frame Bolts

By O. S. MARSHALL

AN interesting tooling equipment for railroad work is illustrated and described in the present article. Locomotive frame bolts, 18 inches long, with a 1 3/4-inch U. S. standard thread at the small end and a long taper near the center, are machined complete in Jones & Lamson flat turret lathes, tooled as shown in Fig. 5. This illustration shows a top view of the tooling equipment, which occupies all the six stations in the turret. A completed bolt is shown at the first station. The taper templet is swung free of the turret tools as indicated, and is only set in the operating position when the proper station is reached for turning the taper.

The bolts are made from forgings, necessitating the use of a three-jawed chuck of the V-type for holding the hexagonal head. A three-jawed scroll chuck is mounted in the first station of the turret for centering or truing the outer end of the bolt, as indicated in Fig. 1, where the method employed for securing the forging in the spindle chuck and truing it up at the outer end is shown. The time allowed for this operation is 30 seconds.

At the second station, Fig. 2, the small end of the bolt is faced and chamfered, the outer end being supported by means of a roller support incorporated in the fixture. The time for this operation is 10 seconds. In Fig. 3, the turret is shown indexed to the third station, where the small end of the bolt is being turned preparatory to threading. A roller back-rest supports the work at a point di-

Fig. 3. Turning the Small End of the Bolt that is Later to be Threaded

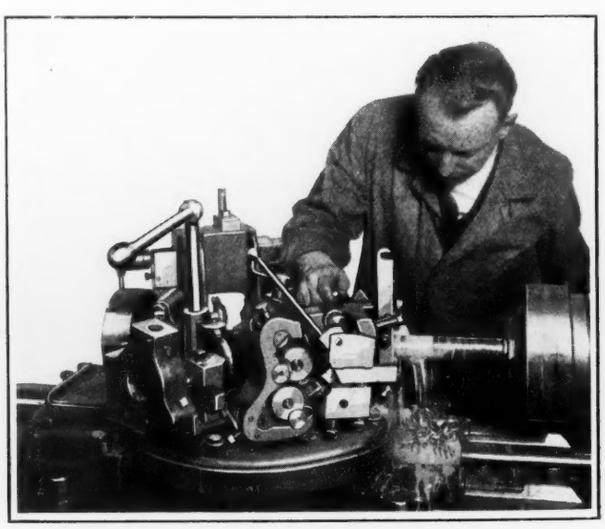


Fig. 4. Necking the Small End of the Bolt Preparatory to Threading

rectly opposite the tool. The time for this operation is 15 seconds.

At the fourth station, Fig. 4, a solid back-rest turner is employed for necking preparatory to threading. The time allowed for this operation is 15 seconds. At the fifth station, Fig. 6, the taper of the bolt is turned. The templet attached to the geared head is swung into position to engage the taper turning fixture. This arrangement assures a high degree of accuracy. The taper turning is completed in 30 seconds.

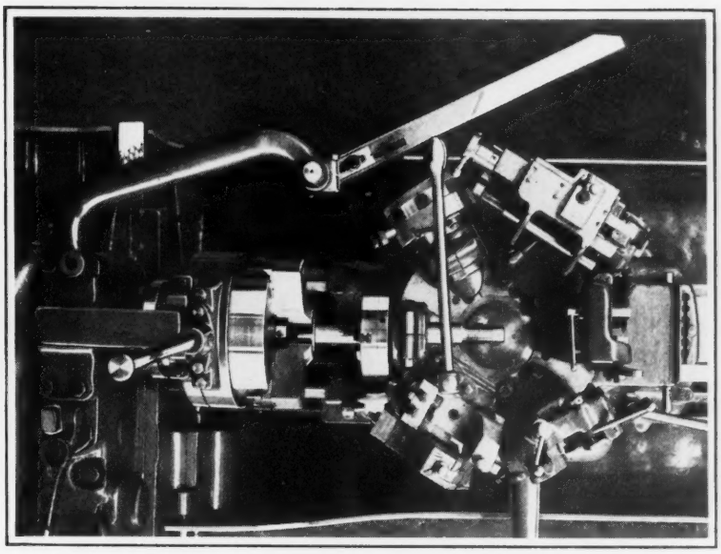


Fig. 5. Flat Turret Lathe Equipped with Tools for Performing all the Machining Operations on a Locomotive Frame Bolt

The threading operation is performed at the sixth station of the turret, Fig. 7, by means of an automatic die. The time required for this operation is 15 seconds. The total time for the complete cycle for machining the frame bolt, floor to floor, is six minutes.

* * *

IMPROVEMENTS IN GRINDING WHEELS

So much has been said about increased production due to the use of improved machinery that sometimes the production made possible by improved tools and accessories is overlooked. Recent improvements in grinding wheels, for example, have made marked savings possible. A leading manufacturer of grinding wheels mentions that through improved structure of wheels, 267 crankshafts are now being ground per wheel, as compared with 200 in the past. In grinding chrome-steel valve stems on a centerless grinding machine, a 20 per cent increase in production per wheel has been obtained. In another instance, steering wheel sleeves are rough-ground on a centerless grinding machine. Formerly the wheels lasted about twenty-eight hours, whereas newly introduced wheels have proved to have a life of forty-eight hours. Still another instance may be mentioned in which the ends of coil springs are ground. Previously about 27,000 springs could be ground by each pair of wheels, while now, 37,000 springs are ground.

* * *

A DEMOUNTABLE RIM FOR BAND SAWS

An interesting new development in the saw line is a demountable rim for band saws which has been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The construction is such that the wheel of the saw is demountable, if for any reason it is desired to exchange wheels, or if that is not necessary, the rubber-faced aluminum rim only can be easily changed in ten minutes—a great improvement over the old method of stretching and cementing a rubber tire on the old type of wheel. The new wheel with demountable rim is so constructed that it can be used on any 36-inch band saw.

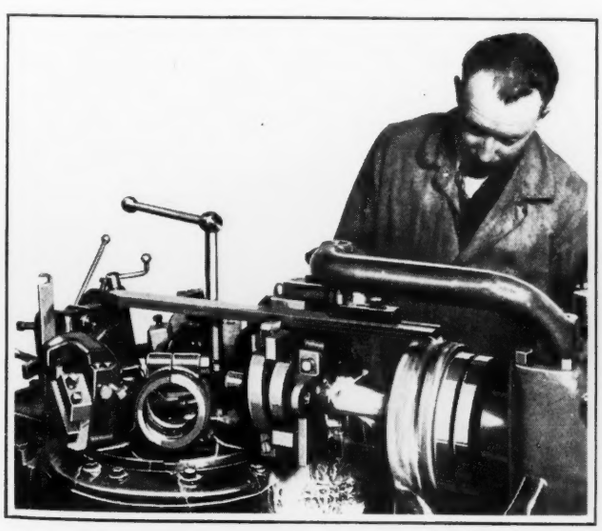


Fig. 6. Turning the Taper on the Bolt, Using a Special Templet

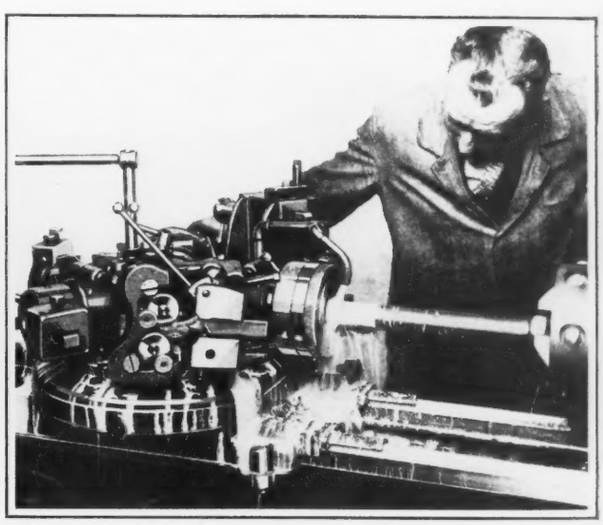


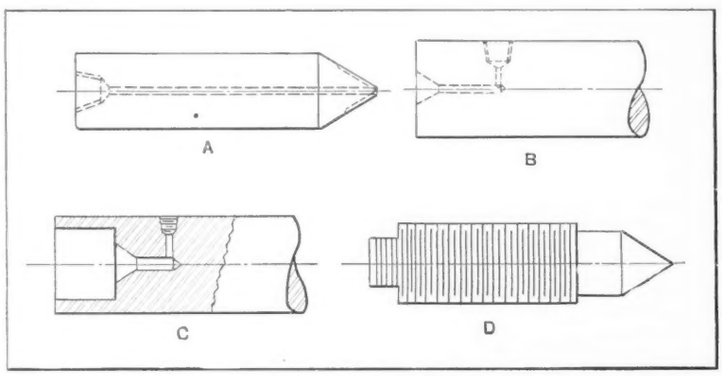
Fig. 7. Cutting the Thread by Means of a Standard Die-head

Important Points on Pivot Bearing Design

By P. H. WHITE

ONE of the simplest forms of bearings, and perhaps one of the oldest, is the pivot or center bearing. It may be used for the most delicate mounting, as well as for very heavy rotating parts that must keep a true alignment under severe stresses. Delicate mountings of this type are to be found in various kinds of precision and electrical instruments and time pieces, where they take the form of jewel mountings. Such bearings offer minimum friction, and when properly mounted and adjusted, will give many years of service without attention, provided the instrument is not abused.

The jewels most commonly used for such mountings are sapphires, rubies, and garnets. For cheaper mountings, ordinary rock crystals are sometimes used. The making of a jewelled mounting consists of selecting and preparing the stones, fitting them to their seats, shaping the pivots and mounting them in the jewels. The stones are drilled either with a diamond drill or with a hardened steel drill and diamond dust. After the hole is drilled, it is finished with a brass or copper lap charged with fine diamond dust. The seat is bored for a snug fit around the jewel, and after the stone is in place, the top edge of the metal is spun over the edge of the jewel to hold it firmly. The hole in the jewel is beveled slightly to form a good bearing for the pivot and an oil reservoir for the lubricant. The pivot is made of hardened steel.



Construction Details of Pivot Bearings

Lubricants generally used for such delicate mountings include porpoise, olive, sperm, and neat's-foot oils, suitably purified and refined. Also, a refined grade of vaseline is sometimes used.

At the other service extreme, the pivot bearing is found standing up under severe service in machine shops the world over. Every piece that is turned or ground between centers makes use of pivot bearings; and when we try to visualize the tons and tons of material that are finished in this way, we realize that this form of bearing must be performing a very satisfactory service. The limited amount of maintenance required by centers and the ease with which they can be trued up have made them an essential piece of machine tool equipment.

It is necessary, of course, to design a pivot bearing to suit the conditions under which it will operate. When it is to support a heavy load, the bearing area must be sufficiently large to keep the unit pressure within a safe limit and thus prevent abrasion. The question of lubrication is of paramount importance in any type of bearing, and with the pivot bearing, it is vital.

Two different arrangements for securing lubrication of pivot bearings are shown in the illustration. At *A*, the pivot is drilled longitudinally along its axis for the entire length, and the outer end is counterbored and tapped for a grease cup. The bearing face of the pivot is grooved outward from the central hole so as to allow the lubricant to flow out and cover the entire bearing surface. At *B*, the clearance hole in the shaft ahead of the bearing for the pivot is continued for a short distance along the axis of the shaft. A cross-hole is drilled radially to meet this axial hole, and the cross-hole is tapped to receive a grease cup. Either of these arrangements is satisfactory, but with arrangement *B*, lubricant cannot be forced into the bearing nor the grease cup filled while the shaft is running. With the arrangement shown at *A*, the grease cup may be filled at will.

At *C* is shown a pivot bearing provided in the shaft of an electrically driven fan. This shaft is counterbored to a depth somewhat greater than the tapered portion of the pivot *D* and to a diameter slightly greater than the diameter of the straight part of the pivot. The bearing is then formed with the proper size of center drill, and the end of the shaft is casehardened to provide a hard wearing surface.

The pivot is a piece of cold-rolled shafting, turned to a 60-degree point on one end and threaded as shown. The end opposite the taper is flattened on two sides to accommodate a wrench which is necessary for adjustment. The tapered end is casehardened. In the assembly, the pivot is mounted on a cross-bar attached to the fan frame. The cross-bar carries a boss which is threaded to receive the pivot. A round lock-nut serves to hold the pivot securely in place when adjusted.

Lubrication is accomplished through the shaft, the counterbored portion forming a reservoir for the lubricant. A good grade of lard oil mixed with white lead is used in this case, and the fan, which has been in operation for more than a year, has required almost no attention except for the occasional supply of lubricant.

Design of an Adjustable Gang Die for Punching Angle-iron

Die with Punching Units which Can Be Located Quickly to Suit Different Jobs by Means of Interchangeable Lay-out Rails

By RUSSELL H. STOUT, Richmond, Ind.

WHEN large quantities of angle-iron are to be punched and many different lay-outs or combinations of holes are required, it is expensive to handle the work on either single or multiple punches of ordinary design. The punching of angle-iron stock having webs from 1 1/2 to 2 1/2 inches in width and from 3/16 to 1/4 inch in thickness, and in lengths from 3 to 11 feet, for example, obviously requires considerable equipment of the regular type, especially when there are as many as 150 different styles or lay-outs for the hole spacings, and the holes vary from 13/32 to 17/32 inch in diameter. Simplification of the equipment needed to handle this work efficiently, as provided for by the adjustable gang type die to be described, is, therefore, a matter of considerable importance to the production engineer and the tool designer.

Large quantities of angle-iron or rails are, of course, handled on single punches. If production costs, time, and accuracy with respect to the relative positions of the holes are all factors of no special importance, the work can be handled on such tools with reasonably satisfactory results. On the other hand, if the holes must be accurately positioned and the work handled rapidly in order to keep the assembly line moving properly, a more versatile and efficient type of punch, such as that described in this article, is required.

Bolsters Designed for Flexible Adjustment

The gang die described in this article has 10-foot bolsters which provide a working space of a little less than 9 feet for the adjustable punch units. The top bolster *A*, Fig. 1, has three slots running its entire length. One slot is for the master rail *B*, while two T-shaped slots are for the bolts that secure the punch-holders *C*, Figs. 1 and 2. The lower bolster *D* has similar slots, one for the master rail *E* and two T-slots for securing die-holders like the one shown at *F*. The bolster *D*, Fig. 1, has an offset slot *R* through which the slugs or punchings pass. This slot is wide enough to take care of any allowable variation in the transverse setting of the die-holders *F*.

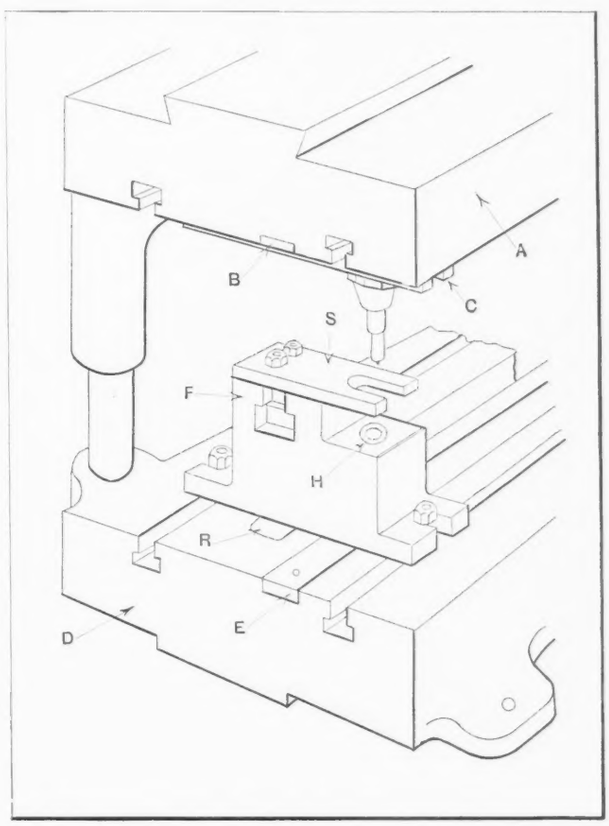


Fig. 1. View Showing Construction of Gang Die Provided with Adjustable Punching Units

Interchangeable and Adjustable Die-holders

A set of punching units, consisting of about thirty-six die-holders like the one shown at *F*, Fig. 2, and thirty-six punch-holders *C*, is desirable for a machine of the size required to handle work of the kind considered in this article. Stripper plates *S* are fastened to the die-holders, as shown in Figs. 1 and 3. The die-holders *F* are located by a 3/8-inch dowel-pin *I*, Fig. 2, directly beneath the center of the die. They are fitted with a standard make of die *H* having an outside diameter of 1 inch.

Several sets of thirty-six complete units for punching holes of various diameters, together with punching units of special shapes and sizes for odd jobs, are kept on hand in the plant where the equipment described is employed. The slug hole *G*, Fig. 2, is drilled at an angle to allow the locating pin *I* to be positioned directly beneath, and in line with, the center of the die *H*. This arrangement permits the lay-out to be made directly on the master rail *E*, Fig. 1. The 5/8-inch slug hole *G*, Fig. 2, when drilled at the angle indicated, will take care of a slug 5/16 inch thick from a 17/32-inch punched hole.

Features of the Adjustable Punch-holders

The punch-holders *C*, Fig. 2, are located by 3/8-inch dowel-pins *J*,

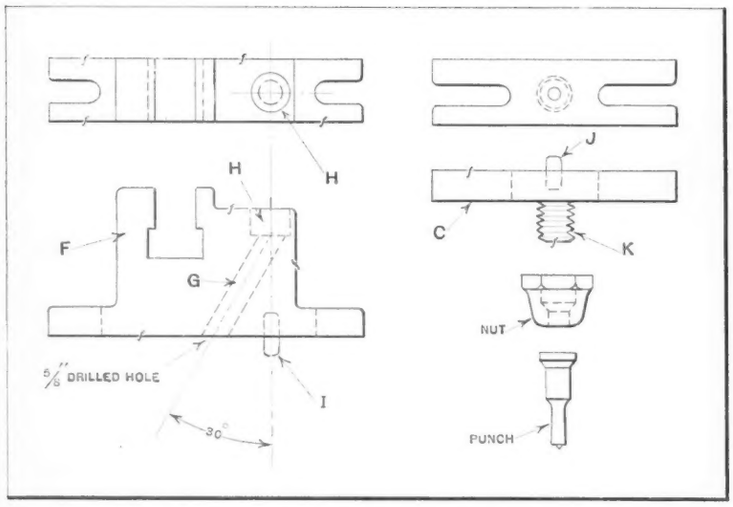


Fig. 2. Die- and Punch-holders which Constitute Adjustable Units of Gang Die

which are close fits in the reamed lay-out holes in the master plate *B*, Fig. 1. The dowel-pins are accurately aligned with the center lines of the punches. The punch-holders are secured to the bolster in the same manner as the die-holders, and are made with studs *K*, Fig. 2, of three different lengths, namely, 1, 15/16, and 3/4 inch. Thus punches of standard length, which can be bought in almost any desired diameter, can be so arranged that their cutting ends will be at different heights. The staggered cutting action obtained by this arrangement results in a substantial reduction in the strain imposed on the press.

Master Rails for Different Lay-outs

The master rails *B* and *E*, Fig. 1, are made of cold-rolled stock and are the same length as the bolster. They are located longitudinally by master pins placed an inch or so from one end, and are in accurate alignment with each other. A pair of master rails *B* and *E* is required for every lay-out or hole-spacing. In some cases, when a small number of holes is to be punched, one design or lay-out may be superimposed on the other, but this practice is undesirable, unless the master rail is well stamped or marked and the operator is quite familiar with the work.

The lay-out holes in both rails of a pair are drilled and reamed at the same time, using a suitable holder. The range of transverse adjustment of the punch units is about 1/2 inch, or 1/4 inch each side of the center line, as indicated by the view of the rail shown at *N*, Fig. 3. At *M* is shown a section of a master rail having all the holes in line. The regular punch- and die-holders are narrow enough to permit punching holes 1 5/8 inches between centers.

Special holders can be made to permit punching holes only 1 or 1 1/4 inches between centers. For closer spacing two set-ups, with two sets of master rails, may be necessary. In some cases, however, the work can be slipped along after the first stroke and completed on the second stroke. Obviously the latter method can be used only when the spacing between each pair of adjacent holes is the same throughout the length of the work. Variations in the distance of the holes from the edge of the angle-iron are obtained by using gages such as indicated at *P*, Fig. 3.

Savings Effected in Production Costs

The saving in production costs resulting from the use of an adjustable gang punch such as de-

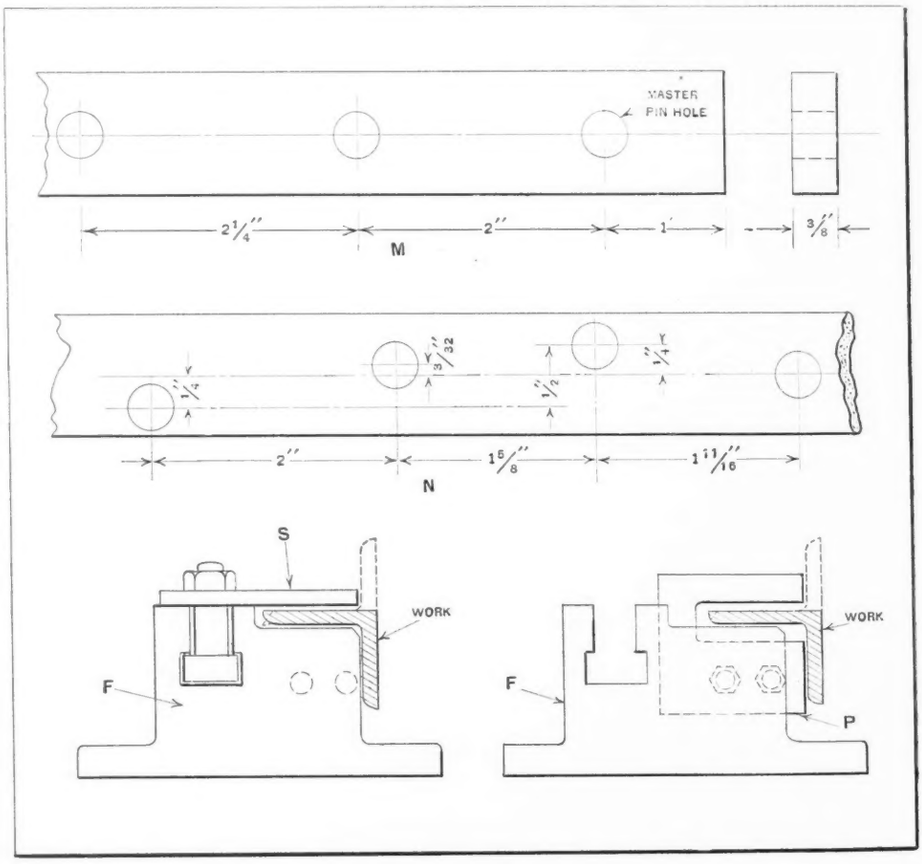


Fig. 3. (M) Master Lay-out Rail for Locating Punching Units; (N) Master Rail with Staggered-hole Lay-out; (F) Die-holders with Strippers S and Work-stops P

scribed, in place of a single punch, is indicated by the following tabulation of comparative costs.

Number of Holes Punched	Cost, Using Adjustable Gang Punch	Cost, Using Single Punch
52	$1.15	$3.42
18	1.17	2.68
41	1.00	1.30
34	1.18	4.80
12	0.50	0.96

The gang punch in this case had an over-all capacity of 106 inches. In all but the last case tabulated, the punch made two strokes, one half of the rail being punched on the first stroke and the remaining half on the second stroke. In some cases, the holes were punched in only one web of the angle-iron, while in other cases, the work was changed end for end in order to punch both webs.

One of the most interesting jobs handled on the gang die consists of punching thirty holes in soft flat steel strips 1 inch by 1/8 inch. This work had previously been handled on a multiple drilling machine, as the accuracy required could not be readily obtained on the single-punch equipment then available. The drilling rate per 100 pieces was $7.80, whereas the new rate established by the gang punch was $2.34, making a saving of approximately 5 1/2 cents per piece.

The following table gives the cost of tearing down and setting up the gang punch units per piece manufactured.

Operation	Cost per Piece
Remove die-holder from machine	0.02 cent
Remove punch-holder from machine	0.02 cent
Remove punch from punch-holder	0.02 cent
Remove die from holder	0.01 cent
Insert new die in holder	0.03 cent
Place complete die-holder in machine	0.03 cent
Insert new punch	0.02 cent
Place complete punch-holder in machine	0.02 cent
Remove master rail	0.04 cent
Insert new master rail	0.03 cent
Set stock gage	0.07 cent

The cost of making a change in set-up can be readily estimated from the preceding tabulation.

Should Production be Guaranteed?

The Sales Manager of a Prominent Machine Tool Company Believes that it is Possible to Guarantee Production

By HARRY B. LINDSAY, Sales Manager, Norton Company

THE editorial on page 98 of October MACHINERY is one to which machine tool manufacturers might be expected to subscribe. Offering production estimates instead of definite guarantees of performance, when all the factors in the customer's shop are not under the seller's control, is the safer procedure. From the purchaser's point of view, however, the case might be stated as follows:

"Performance can be guaranteed, provided all the conditions surrounding that performance are controlled. The prospective purchaser of a machine tool must be confident that his castings are of ordinary density and hardness; work must be properly prepared for the operation that the tool is to perform; cutting tools must be of good quality and properly ground; grinding wheels must be of a suitable grain and grade.

"The finish required can be definitely established by inspection of samples before the estimated production is guaranteed, and it should be understood whether the production is to be obtained by the manufacturer's demonstrator or by the purchaser's operator. Any conditions that are beyond the control of the machine tool builder are to be taken into consideration in determining whether or not the machine has met the promises that were made for it."

When there are three or four tools of similar character from which the prospective buyer must choose, it is extremely confusing to him to receive production estimates varying from 30 to 50 per cent; and it is because such variations are actually matters of record, that this question of guaranteed production estimates is of such importance. To a man who is buying a lathe, a grinder, or a milling machine, it is not a matter for academic discussion, but a question of fact. To quote from an old proverb: "Promises may remain unfulfilled; performance becomes history."

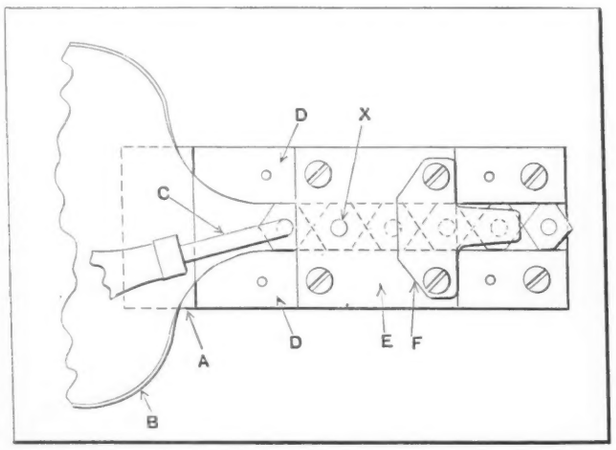
The machine tool industry is selling actual physical production and not estimates of production. We believe that any manufacturer of machine tools who is willing to take the trouble to investigate the conditions under which the machine is to perform can make production estimates which he is willing to guarantee under penalty of removing the machine from the purchaser's plant. If this were not true, it would be impossible to set piece rates in advance of performance by the well-known methods now employed by many factories that are run on an efficient cost accounting basis.

The decision on the acceptance or rejection of production lies always with the purchaser, but when operating conditions can be distinctly and exactly described, any manufacturer of a standard machine tool ought to be able and willing to guarantee his production estimates.

[The subject of production guarantees is one of great importance. Manufacturers and users are invited to discuss it in MACHINERY.—EDITOR]

Ideas for the Shop and Drafting-room

Time- and Labor-saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work



Tapping Jig in which Nuts are Fed by Means of a Hand Tool

SIMPLE JIG WITH CHUTE FEED FOR TAPPING NUTS

A simple jig for tapping hexagonal or square nuts and other parts blanked from flat stock is shown in the accompanying illustration. It is used in connection with an ordinary single-spindle tapping head in a drill press when the production is not large enough to warrant more expensive equipment.

It consists primarily of a pack-hardened steel block *A*, fastened to the drill press table, to which is secured the stock pan *B*, work-guides *D*, stripper plate *E*, and the work retarder *F*. The stock pan *B* is flush with the top of the block *A*, and is secured to it by soldering. The nuts are fed into position by means of the tool *C*, the point of which has a downward bend and is a loose fit in the hole in the nut.

In operation, a supply of nuts is placed in the stock pan, a few being scattered near the entrance to the guides. Then the bent end of the feeding tool is inserted in a nut and it is pushed between the guides. Another nut is fed forward in the same way until the feeding tool strikes the edge of the stripper.

In the meantime, the first nut has been pushed along until its hole is approximately in line with the clearance hole *X*. This hole is drilled through the stripper plate, the tap being allowed to pass through and into the nut. As the guides become filled with nuts, the retarding spring *F* exerts sufficient pressure on them so that they will have a uniform feeding movement. From the end of the chute, the nuts drop into a container placed on the floor.

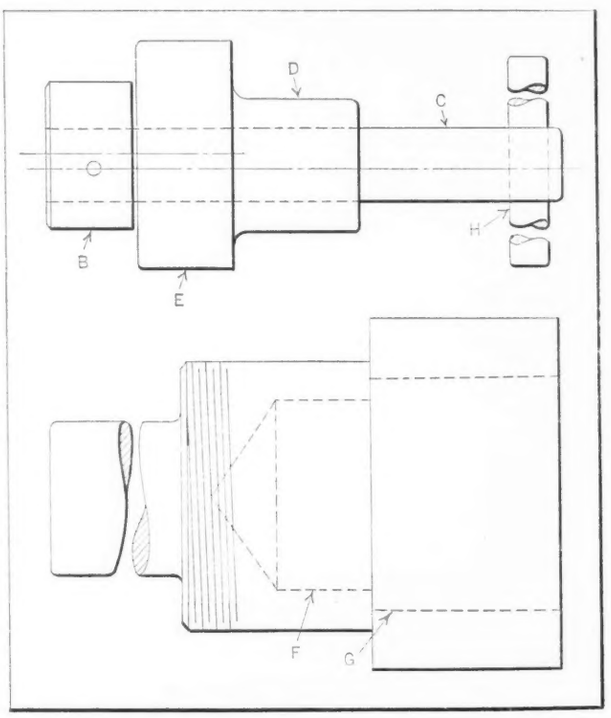
Farmington, Conn. ERNEST L. HOLCOMB

INTERNAL WRENCH OF THE ECCENTRIC TYPE

In the upper view of the accompanying illustration is shown a wrench designed for removing transmission clutch hubs from a lathe adapter. The clutch hub, shown in the lower view, is screwed into the adapter tightly, with the large end projecting. Previous to the use of the wrench shown, the work was frequently marred when it was removed.

With this wrench, however, the trouble was overcome. In the eccentric member *B* is a hole in which the round bar *C* is fastened and doweled. Bushing *D* is a sliding fit on bar *C* and is free to turn on it; the outside diameter *E* of the bushing is also eccentric with the bar, the eccentricity being the same as that of member *B*. The outside diameters of parts *B* and *D* are slip fits in the holes *F* and *G*, respectively.

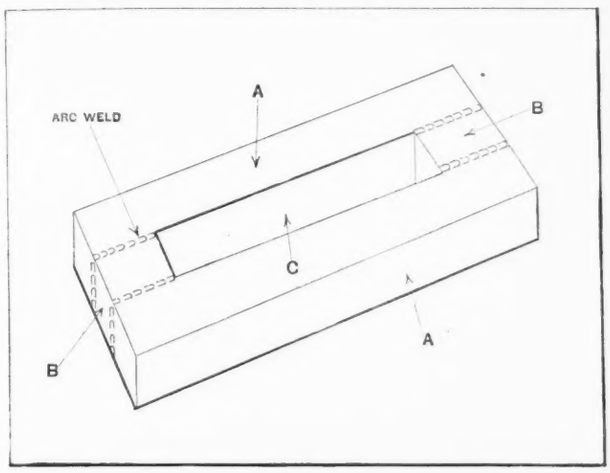
To use the wrench, the member *D* is slid up to the cross-handle *H* and the eccentric *B* is inserted in the hole *F*. Bushing *D* is now moved toward the work and revolved until its outside circumference corresponds with that of hole *G*, after which it is pushed into the work as far as it will go. The operator then grips the projecting part of the bushing *D* and twists the eccentric *B* by means of the handle *H*, which produces a wedging action be-



Wrench in which the Gripping Action is Effected by Two Eccentrics

tween the work and members *B* and *D*. The gripping pressure increases as the force applied to the handle *H* is increased; hence, the work is easily unscrewed without marring it.

Cleveland, Ohio — RUDOLF SPACEK



Core-box Made up of Welded Pieces of Square Iron Bar Stock

SIMPLE METHOD OF MAKING A CORE-BOX

A simple and perhaps novel way of making metal core-boxes for square or oblong cores is used in our shop. In making a core-box for an oblong core, 3/8 inch wide by 3/8 inch deep, for example, we take a section of bar iron 3/8 inch square, cut this to the required lengths, and place the pieces in the position shown in the illustration. The lengths *A* form the sides, and the short pieces *B* form the ends of the core-box. These pieces are welded together, as indicated. An opening *C* of accurate size is thus produced for forming or molding the core.

Preston, Victoria, Australia — C. J. DROLZ

A PLANER KINK

The usual method of preventing the cutting tool from breaking off the edge of the work at the end of the planer stroke is to file a bevel at this end. Another method used successfully on an aluminum casting is to cut a groove about 1/32 inch deep across the end of the work at a height equal to that of the finished surface. The groove is cut by means of a flat cold chisel held in a position parallel to the surface to be planed. In order to obtain a straight groove, a line is first scribed on the end of the work to the proper height by means of a surface gage. The groove may then be cut evenly by simply following this line with the cutting edge of the chisel.

Detroit, Mich. — HARRY GOSLOW

CASTOR OIL FOR LUBRICATING BEARINGS SUBJECTED TO HEAT

Castor oil is one of the best lubricants for bearings and sprockets that operate in enameling ovens or in any place where the parts to be lubricated are subjected to excessive heat. No oil will keep the bearings and sprockets in an enameling oven cool, but castor oil will prevent excessive wear. It will not cake or cause scale to form on the parts as most other oils do, and will not ignite from the heat of the oven like most oils; it is therefore safer. An oil-pipe can be installed through the top of the oven for conducting the oil to the bearings. A very small amount of oil is sufficient in most cases, and the feed should be regulated so that there will be no excess oil to drip on the work.

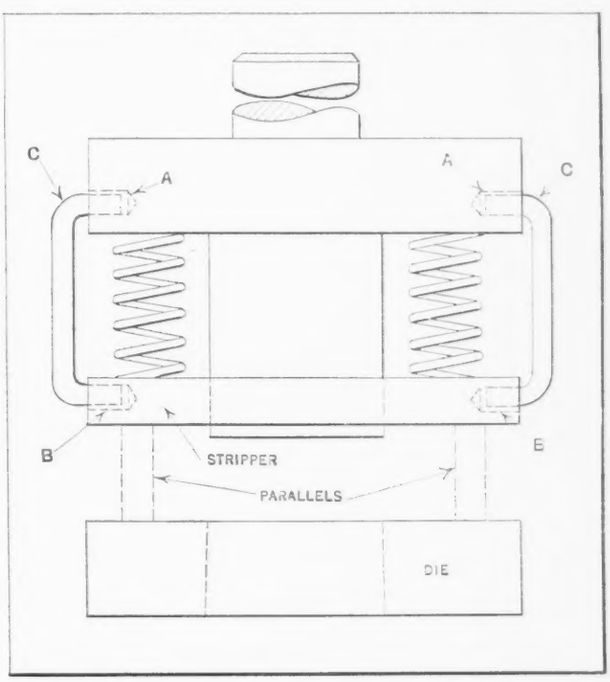
Denver, Colo. — R. M. THOMAS

SETTING UP A DIE EQUIPPED WITH A SPRING STRIPPER

On reading the article "Detachable Stripper Plate," on page 126 of October, 1930, MACHINERY, it occurred to the writer that the method used at the plant of the Moore Special Tool Co., Inc., Bridgeport, Conn., for lining up the die opening with the punch when the latter is equipped with a spring-actuated stripper might also be of interest. As shown in the accompanying illustration, two holes *A* are drilled in the punch-holder to correspond with holes *B* drilled in the stripper; two hooks *C* inserted in these holes serve to hold the stripper against the pressure exerted by the springs.

With the hooks holding the stripper as illustrated, the punch projects a sufficient amount to align the die member. An easy method of compressing the springs to permit the hooks *C* to be put in place or removed after aligning the die with the punch is to bring the stripper down on two parallels placed as indicated by the dotted lines.

Bridgeport, Conn. — R. F. MOORE



Method of Holding Stripper up to Facilitate Aligning the Punch and Die

Questions and Answers

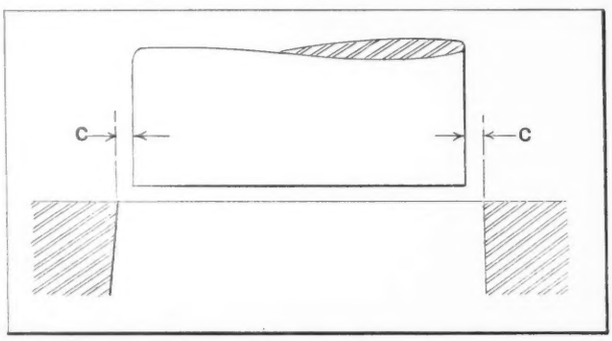
A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

A. S. D.—When pneumatic tools fail to operate properly, it is sometimes difficult to determine whether the trouble results from the tools consuming too much air or from failure of the compressors to supply air at their rated capacities. Is there a simple method by which the actual output of the air compressor can be determined in cases of this kind? The compressors under consideration are of the portable engine-driven type such as contractors use.

Answered by R. H. Parrish, Alamo Iron Works, San Antonio, Tex.

Recently the writer had occasion to devise a means of determining whether or not the air compressors that our company regularly rents to contractors were delivering air at their rated capacities after being overhauled in our shop. The following is an outline of the method devised for checking the output of air compressors having rated capacities of 60 and 120 cubic feet of air per minute, respectively.

The smallest machine we rent carries an air tank having a capacity of 4.88 cubic feet. Arbitrarily choosing 75 pounds per square inch as the tank pressure for the test, we can assume that when the gage shows a pressure of 75 pounds, the compressor has delivered into the tank an amount of air equivalent to $4.88 \times 6.1 = 29.8$ cubic feet. The value 6.1 in this equation is the volumetric ratio at 75 pounds pressure per square inch and atmospheric pressure, respectively. That is, 4.88 cubic feet of air at 75 pounds pressure per square inch is equivalent to 29.8 cubic feet of air at the atmospheric pressure of 14.7 pounds per square inch.



In Some Shops, "Clearance" Means Space C; in Others, it is Twice Space C or, in the Case of Round Dies, the Total Difference between the Punch and Die Diameters

Therefore, the time required for a 60 cubic foot machine to develop a pressure of 75 pounds per square inch in the tank when working properly equals $(29.8 \div 60) \times 60 = 29.8$ seconds. Now since the 120 cubic foot machine carries the same sized air tank, the time required to develop a pressure of 75 pounds per square inch equals $(29.8 \div 120) \times 60 = 14.9$ seconds. The checking method described has been found sufficiently accurate to meet our requirements, and can be used by the operator in the field as well as by the mechanic in the shop in cases where the question arises as to whether a machine is delivering its rated output.

M. A. H.—When the term "clearance" is used to indicate the space between a punch and die, does it refer to the total difference between the punch and die sizes or to one-half of this difference only? For example, if a die is round and if it has a clearance of 0.010 inch, does this represent a difference of 0.010 inch between the punch and die diameters?

A.—There is a difference of opinion among diemakers as to the method of designating clearance. In order to obtain definite information in regard to the prevailing practice, data has been secured from fourteen firms specializing in die work. Seven of these firms define clearance as the space C (see diagram) between the punch and die on each side, or one-half the difference between the punch and die sizes. The remaining seven firms consider clearance as the total difference between the punch and die sizes or $2 \times C$.

Some of the firms in the first group pointed out that the advantage of designating clearance as the space C on each side is particularly evident in the case of numerous dies of irregular form or dies of angular shape. In other words, while the practice of designating clearance as the difference between the punch and die diameters may be satisfactory in the case of round dies, it leads to confusion when the dies are of special unsymmetrical forms. One firm also refers to the advantage of measuring clearance on one side only by using a thickness gage, especially when the shape of the die opening is irregular.

It is evident from the foregoing that the term "clearance" should not be used in specifications without indicating clearly just what it means. According to the practice of one prominent manufacturer of dies, the term "cutting clearance" is used to indicate the space between the punch and die on each side, and the term "die clearance" refers to the angular clearance provided below the cutting edge so that the parts will clear as they fall through the die.

* * *

In 1930, not less than 561,000 American cars and trucks were sold abroad. This is equivalent to 16 per cent of the entire production. The number of automobiles imported into the United States was 625.

Multiple Tools Used on Cylinder Blocks

Tappet-valve Holes and Seats are Drilled, Reamed, and Spot-faced in Four Operations with Two Tools Mounted on Each Spindle

CONCENTRICITY of tappet-valve holes and seats is an important requirement in machining automobile cylinder blocks. At the plant of the Autocar Co., Ardmore, Pa., accuracy of these holes and seats is obtained by the use of multiple tools on rail-type drilling machines equipped with twenty-four spindles, so that two cylinder blocks can be operated on at the same time. Two tools are mounted on each spindle to suit the four different operations performed.

In addition to insuring concentricity of the different surfaces within close limits, the use of multiple tools increases production. On this particular job, the work is done in four operations instead of eight, which would be required if only one cutter were used on each spindle. All the tools used in these operations and their full-floating holders were made by the Gairing Tool Co., Detroit, Mich.

Combination Core-drill and Reamer Used in the First Operation

Briefly, the four operations consist of finishing the valve-seat holes *A*, Fig. 1; the guide holes *B;* the valve spring seat surfaces *C* and *D;* and the holes *E*.

The first operation consists of core-drilling and semi-finish-reaming the twelve holes *E*, with the cylinder casting turned bottom side up, by employing tools such as shown at *W*, Fig. 3. The cuts are taken by a combination tool *F*, which consists of a spiral-fluted core-drill and a straight-fluted reamer. The holes are drilled to 1.616 inches and reamed to 1.641 inches. Each set of tools is steadied during the cut by a pilot 1 3/4 inches in diameter engaging sleeve *S*.

The sleeves are 5 3/4 inches long, and are held in a head such as those seen in the heading illustration, which is raised and lowered with the machine spindles so that the pilots never leave the sleeves.

Finishing the Seat and Guide Holes

The second operation is performed with the tools shown at *X*, Fig. 3, the cylinder being placed on the machine table right side up. This consists of rough-drilling the tappet guide holes *B*, Fig. 1, and core-drilling the seat holes *A*. The drilling of the guide holes is accomplished by means of drills such as shown at *G*, Fig. 3, while spiral-fluted core-drills of the type illustrated at *H* are used for machining the seat holes.

Core-drills *H* are 1.860 inches in diameter for the intake-valve seat holes, and 1.735 inches for the exhaust-valve seat holes. Correspondingly, the pilots and sleeves *S* for the intake-valve seat holes

are 1.9375 inches in diameter, and for the exhaust-valve seat holes 1.8125 inches. Drills *G* are 47/64 inch in diameter for all guide holes.

Fig. 2 shows the complete tooling set-up for the third operation. In this operation, the guide holes are finish-reamed by straight-fluted reamers such as shown at *J* in diagram *Y*, Fig. 3, and the seat holes are reamed simultaneously by straight-fluted tools of the type illustrated at *K*. The tools used in this operation are guided above by a pilot that enters sleeve *S*, and below by a pilot that enters bushing *T*. The lower pilot is integral with the guide hole reamer *J*. The twelve bushings *T* are in the work-holding fixture.

Reamers *K* for the intake-valve seat holes are 1.8756 inches in diameter, and for the exhaust-valve seat holes, 1.7506 inches in diameter. Reamers *J* are 0.7496 inch in diameter for all holes. These guide holes are held to size within plus 0.0005 inch and minus 0.0000 inch. Sleeves *S* for these tools are 3 inches long, and bushings *T*, 4 1/2 inches long.

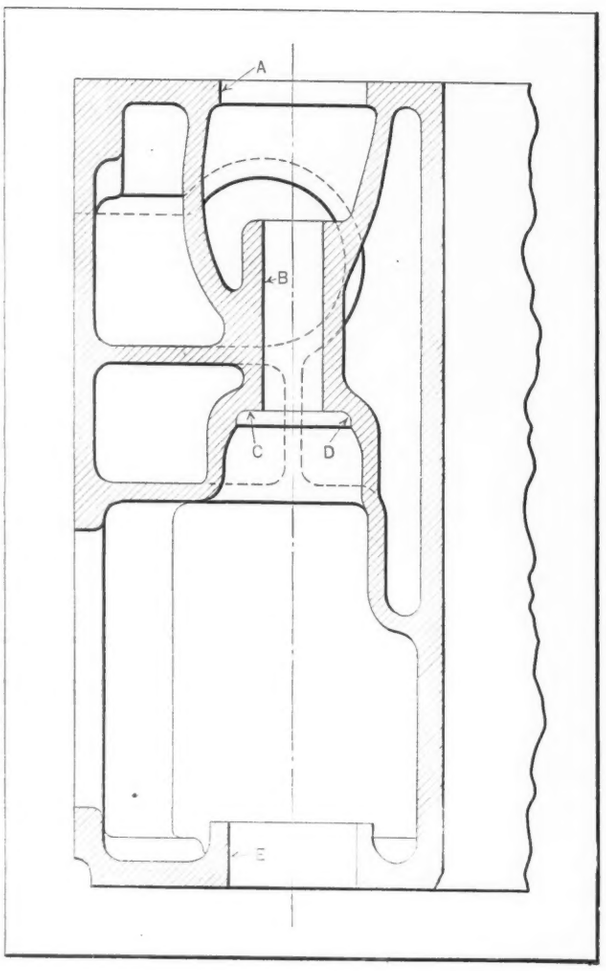


Fig. 1. Cross-sectional View of Cylinder Block

Finish-reaming the Bottom Holes and Spot-facing the Spring Seats

The fourth and final operation is performed with the cylinder casting again turned upside down by employing the tools illustrated at *Z*, Fig. 3. It consists of finish-reaming the bottom holes *E*, Fig. 1, with straight-fluted reamers such as shown at *L*, Fig. 3, and finishing surfaces *C* and *D*, Fig. 1, with a four-fluted spot-facer of the type illustrated at *M*, Fig. 3. In this operation roller pilots *N* enter the previously reamed guide holes, and pilots engage the long sleeves *S*. Reamers *L* have ten flutes, and are 1.6565 inches in diameter.

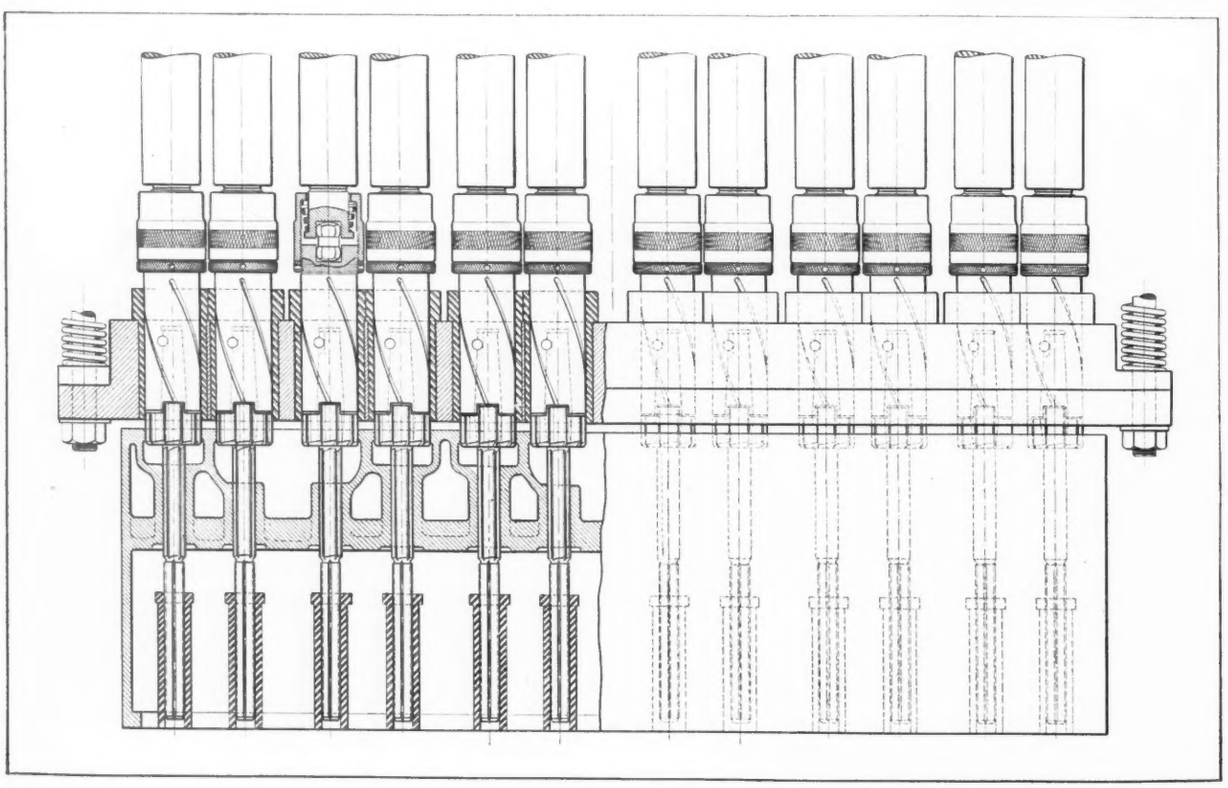


Fig. 2. Complete Tooling Equipment Employed in the Third Operation on the Cylinder Block

TENDENCIES IN MACHINE TOOL DESIGN

In a paper read by R. C. Fenton of Alfred Herbert, Ltd., before the Institution of Production Engineers of Great Britain, at the Manchester Municipal College of Technology, the present tendencies in machine tool design were briefly summarized as follows:

1. Grouping of the controlling elements so that they may be reached conveniently by the operator.

2. Provision of power-controlled traversing motions and automatic clamping devices, as well as other means for reducing fatigue.

3. Automatic stops and gaging devices to compensate for varying skill and to obtain a uniformly accurate product.

4. The use of quick-change gear-boxes to save time and calculations.

5. Central lubrication to guard against forgetfulness and to save the operator's time.

6. Unit system of construction to facilitate manufacture and repair.

7. Provision of guards and other safety devices to minimize accidents.

Mr. Fenton also called attention to the rivalry between the cutting tool and the machine in which it is used. About two years ago, this war between tool and machine was brought to an end with the victory of the machine, but the strife is now renewed with new forms of tools and cutters, of which the tungsten-carbide alloys are the most generally known. To meet the new conditions, it is necessary in designing machine tools, according to Mr. Fenton, to keep the following points in mind:

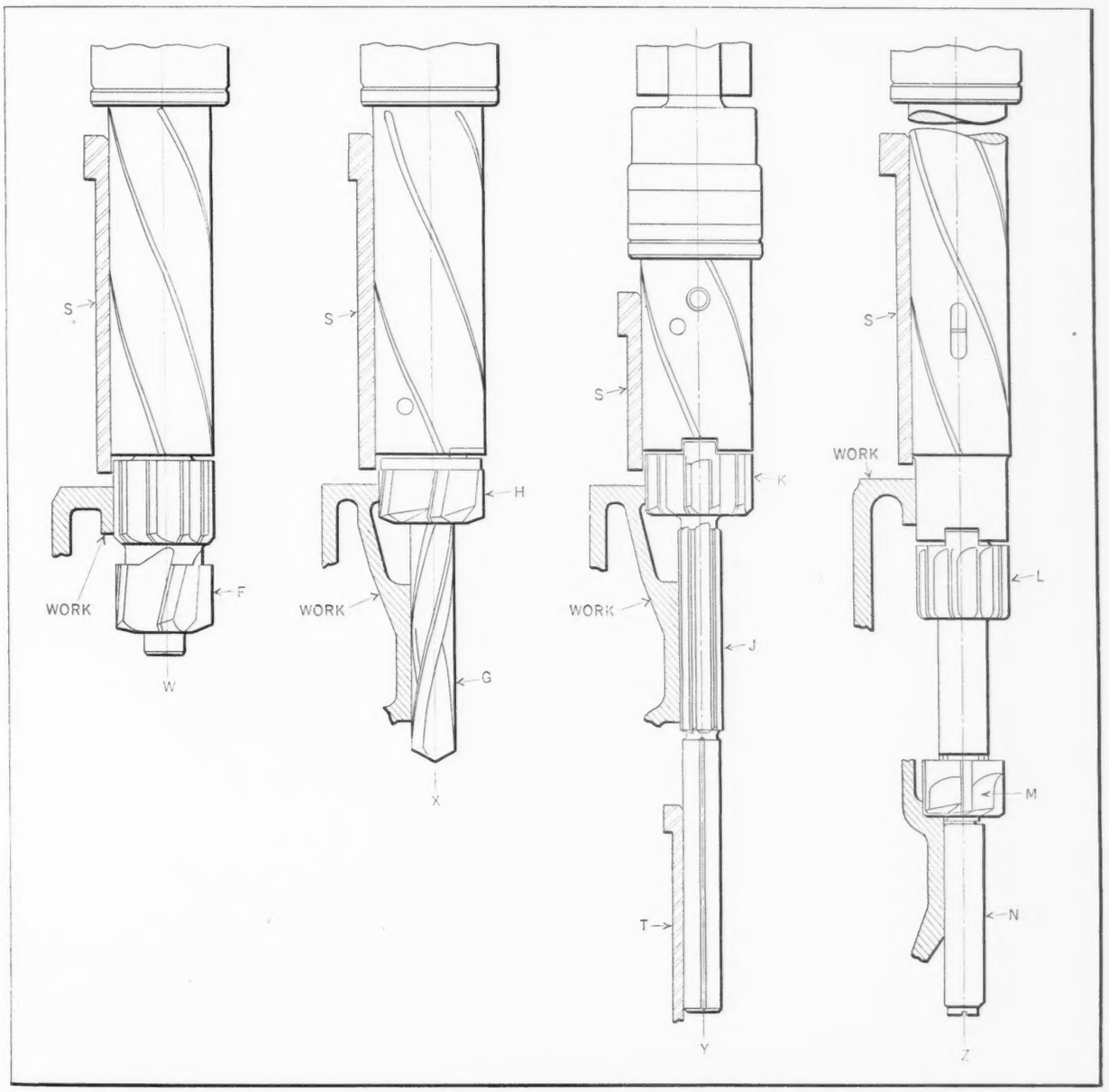


Fig. 3. Tools Employed in Four Operations for Finishing the Tappet Valve Holes of Cylinder Blocks

1. More power must be transmitted to the point of cutting, and this entails the use of ball and roller bearings, sliding gears in place of clutches, and splined shafts.

2. The slides and tool supports must be more rigid, so as to resist vibration better.

3. There must be more speeds and feeds.

4. The machine must be better protected against chips.

5. Better provision must be made for coolant.

6. There must be means for disposing of chips.

[Many machine tools of recent design incorporate several of these improvements.—EDITOR]

* * *

According to information published in the *Economic Review* of the Soviet Union, the value of American machine tools, bought or contracted for from 1926 to the end of the fiscal year 1930, was about $27,000,000. The amount bought in the fiscal year 1926-27 was valued at $1,210,000; in 1927-28, $1,590,000; in 1928-29, $5,200,000; and in 1929-30, $18,280,000. This equipment has been bought through the Amtorg Trading Corporation, 261 Fifth Ave., New York City, and has been acquired from more than 160 American machine tool builders. These figures, according to Mr. Markoff, vice-president of the Amtorg Corporation, represent only a small part of the machine tool equipment imported into the Soviet Union from abroad, as the greater part of this equipment has been bought in Europe.

* * *

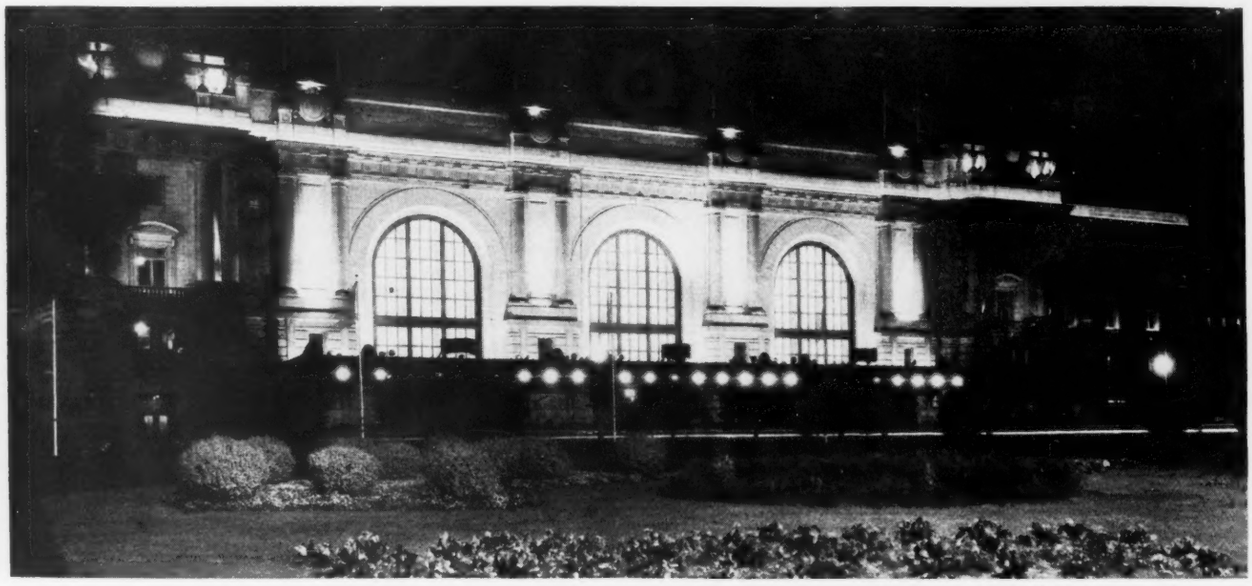
Several railroads are combating the bus competition by the obvious method of providing bus service themselves. The railroads now operate close to 3000 motor buses all over the country.

Cylindrical Grinding with Air-Operated Tooling

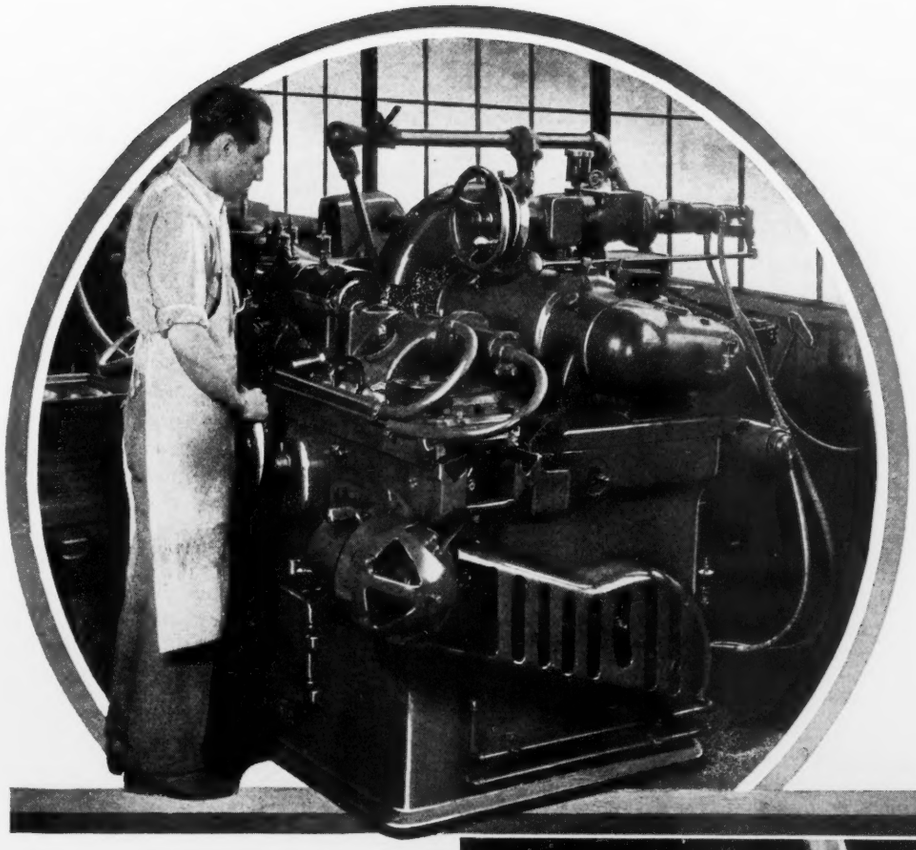
Special tooling for the purpose of increasing production on different types of grinding machines has been given serious consideration within the last few years. As a result, many ingenious fixtures have been devised to facilitate operation. An example of such equipment is shown in the illustrations on the opposite page. This set-up is employed in the plant of the Maytag Co., Newton, Iowa, for grinding the cylindrical surfaces on worm-wheel eccentrics used in a washing machine built by this company. The work is done on a plain hydraulic grinding machine, both the tools and the grinding machine being made by the Landis Tool Co.

The tooling consists mainly of a headstock having a live spindle equipped with a pneumatic chuck, and a tailstock having a sliding spindle which is also operated pneumatically. On the end of the sliding spindle is a cup-center for locating the work accurately before the chuck jaws are tightened. To load the fixture, the work is placed between the chuck jaws. Two studs are provided in the chuck face, one for accurately locating the outer part of the work, and the other for centralizing the portion to be ground approximately, so that the cup-center will slide over this portion easily without being guided by hand.

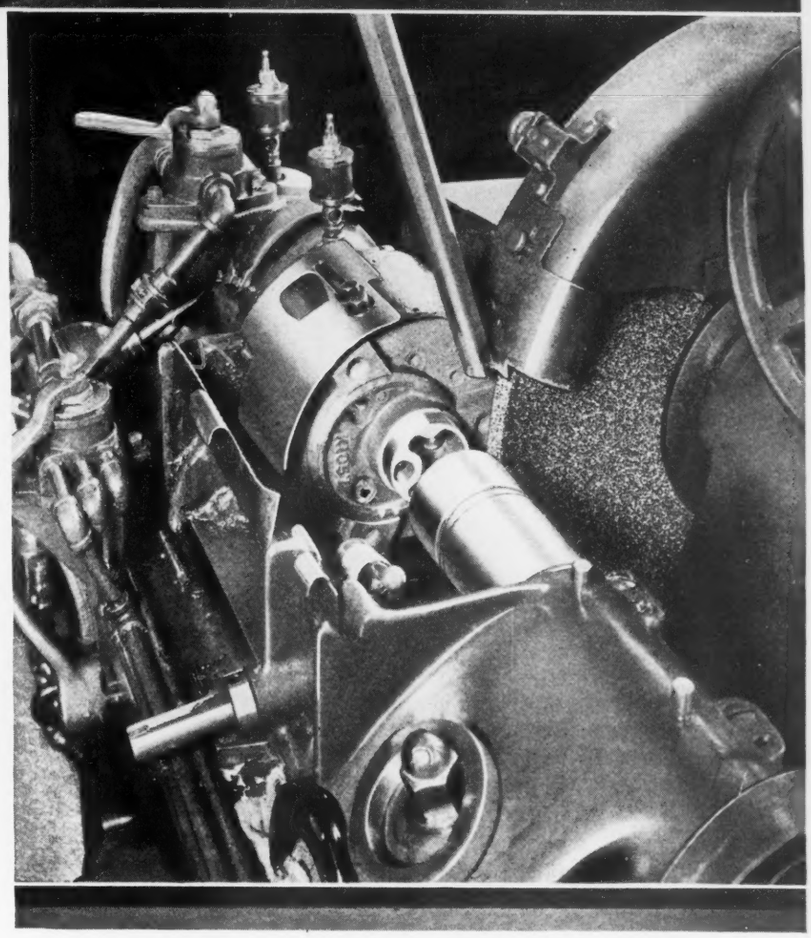
Next an air valve is opened, which causes the tailstock spindle to move toward the left until the cup-center slides over the turned part of the work. Another valve is now opened, causing the chuck jaws to grip the work securely, after which the tailstock spindle is backed away. Incidentally, it may be mentioned that the tailstock spindle, besides serving as a final locator, also holds the work



The Civic Auditorium in San Francisco, where from February 16 to 20, the National Western Metal and Machinery Exhibition under the Auspices of the American Society for Steel Treating will be Held



The Operation of this Pneumatic Tooling Equipment for Grinding the Eccentric Shown in the View Below is Controlled Entirely by Two Valve Levers



For Grinding the Eccentric, the Work is Gripped in a Pneumatic Chuck and Centralized by the Cup-shaped End of the Air-operated Tailstock Spindle Shown

against the chuck face while the jaws are being tightened.

The grinding wheel may now be fed into the work to the proper depth. However, just before the wheel comes in contact with the work, its movement is slowed down to a predetermined grinding feed, which continues until the work has been ground to size, as determined by a positive stop. By shifting one of the controls, the wheel-base is then moved back rapidly to its starting position. At this time the work is unchucked by shifting the air-valve lever controlling the chuck jaws.

Eight hundred pieces per nine-hour day, or approximately ninety pieces per hour, are ground with this equipment. The material of which the work is composed is gray iron, and the grinding limits are plus or minus 0.0005 inch. To facilitate the operation, the air valves are located so that a minimum number of moves are required by the operator.

Do Improved Machines Cause Unemployment?*

A Study Covering the Last Thirty Years Shows Conclusively that the Idea that Machines Have Reduced the Opportunity for Employment in the Industries is Erroneous

By FRANKLYN HOBBS
Director of Research, Central Trust Co. of Illinois, Chicago, Ill.

ACCURATE information in regard to all industrial operations of consequence is available to anyone who cares to obtain it. Some men of large affairs and many men of small affairs lack the time and facilities to collect this information for themselves, but there are numerous statistical bureaus whose object it is to gather, correlate, and disseminate the actual facts concerning fundamental business operation.

A Popular Fallacy is Disproved by the Facts

In the course of carrying on this statistical work at the Central Trust Co. of Illinois, a comparison was made between the figures of the manufacturing census of 1899 and the period of industrial development during the last thirty years. These figures show that some of the current ideas of many leading manufacturers and of every labor union in the manufacturing field regarding unemployment are based on a wrong assumption—on opinion or guess rather than on accurate information.

The fact brought out by this investigation is that automatic and labor-saving machines and appliances have not displaced workers in certain branches of industry as rapidly as they have opened up avenues of employment in other branches.

Had there been no labor-saving machines introduced into the factories of the world during the last forty years, there would have been few electrical appliances, few telephones, few automobiles, and perhaps no moving pictures, no radios, and no airplanes. The introduction of labor-saving machinery has resulted in the development of great new industries, and has made it possible for the ordinary factory worker and farmer to enjoy comforts and luxuries that even the wealthy could not command a century ago.

It is true that during the last thirty years improved machines and tools have driven two workers out of every three away from the bench or machine where they were employed, leaving the third to draw an average pay in dollars and cents equal to that received by all three men thirty years ago; but the two men who lost their jobs are soon employed in other industries and occupations at an increased wage. It is easy to show that improved machines have thrown thousands of men out of jobs, but it is just as easy to prove that improved machines have created thousands of new jobs at higher pay. Factory workers today earn, in dollars and cents, three times as much as the same class of workers earned thirty years ago.

In 1899, this country had a population of 76,000,000 people, of whom 6 per cent were employed in factories. At the beginning of last year, the population was 121,000,000, and more than 7 per cent were employed in factories. The demand for factory workers is thus shown to have increased at a faster rate than the population. That this increased employment is due directly to the introduction of improved machinery is a reasonable assumption, because the gain in factory employment in this country is greater than in any other country of which we have any record. In other countries, however, increased employment in factories has taken place in proportion to the introduction of improved machinery. Thus we have a mathematical proof that the introduction of machinery in manufacturing operations has not caused unemployment.

Improved Machinery Has Also Increased Wages

The wage side of the question may be dismissed with the simple statement that the factory worker in 1899 was earning, on an average, $426 a year in this country, while in 1929, he averaged $1318. Even allowing for the reduced purchasing power of the dollar, the increase in wages is substantial.

Going outside of the manufacturing enterprises, and taking in all the country's workers, whether they wear overalls or white collars, we find another fact

Factory Employment, 1899-1929

Year	Number of Workers	Percentage of Population of U. S.	Average Annual Pay per Worker
1899	4,713,000	6	$426
1904	5,468,000	7	477
1909	6,615,000	7	518
1914	6,895,000	7	590
1919	9,000,000	9	1,162
1921	6,944,000	6	1,181
1923	8,777,000	8	1,254
1925	8,382,000	7	1,280
1927	8,350,000	7	1,299
1929	8,550,000	7	1,318

*Abstract of an address entitled "The Machine Age and Its Consequences," presented before the Machine Tool Distributors of Chicago, January 9.

regarding employment that may surprise many. There has been no reduction in the proportion of the number of people that are gainfully employed. A generation ago, 38 per cent of the whole population were so employed and now 39 per cent are gainfully employed. Apparently, in order that we may be supplied with the goods and services that our present mode of living demands, it is necessary that at least as large a proportion of our population be employed as formerly.

Shorter hours, longer vacations, and increased consumption have made necessary a slight increase in the percentage of the population that works for a living, as well as a gain of one-sixth in the percentage of the population employed in factories. If hours are shortened further, it will be necessary to improve machinery correspondingly, or an additional number of people must become gainfully employed, if we are to maintain the same standards of living.

In conclusion, the following facts should be emphasized: There were 4,700,000 workers in the mills and factories of the United States thirty years ago. There were 8,500,000 at work in the factories in 1929. Only 6 per cent of the population worked in the manufacturing industries thirty years ago; 7 per cent were so employed in 1929. Wages of factory workers, as expressed in dollars and cents, have trebled in thirty years.

The machine age has increased employment, increased wages, made work easier, saved life and limb, and enabled the workers to enjoy as everyday comforts conveniences that were either luxuries or unknown to their fathers and grandfathers.

When is a Machine Tool Obsolete?

At the Annual Meeting of the Society of Automotive Engineers in Detroit, the Subject of Machine Tool Obsolescence was Discussed from Many Angles

AN unusually interesting discussion relating to the obsolescence of machine tools took place at the production session held by the Society of Automotive Engineers in conjunction with its annual meeting in Detroit January 19 to 23. The subject was introduced by a paper entitled "Controlling Factors in Machine Tool Obsolescence," presented by L. A. Blackburn, formerly with the Oakland Motor Car Co.; J. W. Brussel, works manager, Timken-Detroit Axle Co.; and A. R. Fors, planning manager, Continental Motors Corporation.

In introducing the subject, the authors stated that the true meaning of the word "obsolete" is misleading so far as it concerns machine tools. The average person understands the word "obsolete" to mean worn out or no longer in use. But actually, in modern shop operation, the word "obsolescence" relates to a fact that is concerned only with the economic value of an article and not its physical condition. We will therefore follow the latter definition of obsolescence rather than that of the dictionary.

We can best illustrate this by the fact that an automobile built ten years ago, taken directly from the assembly line and put in storage, would have very little value today. The physical condition of a machine may be as good as the day it was built. In fact, it may never have been used, and still its economic value may not justify setting it up.

What Factors Determine Obsolescence of Machine Tools?

The important question is, "How are we to determine when a machine tool is obsolete?" We must devise ways and means of proving that the investment we are asking the management to make in replacing equipment will earn a satisfactory return on the money for which we are asking. The same elements enter here that enter into making any other investment; the risk must be compensated for by the size of the return. One shop having a staple production may think a 15 per cent return on its investment is sufficient, while another, whose production is susceptible to frequent changes can, with perfect propriety, insist on a 50 per cent return.

Yield may be divided into two divisions, visible and invisible. The former is represented by the direct savings effected through the use of the new equipment on a probable production forecast. The invisible yield cannot be easily ascertained. It takes the form of greater accuracy, a smaller inventory, or the possibility of working a select crew of skilled men rather than a larger force of average ability. Liquidity is a minor factor, and is represented by fair salvage value of the equipment. A standard machine for which there is a larger demand has a greater liquid value than one for which the demand is limited.

Formulas for Determining When to Replace Equipment

Several formulas were quoted by the authors as useful in determining when a machine tool ought to be replaced for the sake of economy. Among the formulas specifically referred to were those known as the Warner & Swasey formula, the S K F formula, and the A. S. M. E. formula. Some of these formulas include practically all the conceivable factors that enter into the problem, while others are simplified, eliminating the factors that do not have a very great influence on the problem, and incorporating mainly the cost of the new machine,

the salvage value of the old machine, the hourly cost of the old machine, the hourly cost of the new machine, and the hourly production of old and new machines.

For ordinary purposes, such a simplified formula is sufficient. In this simplified formula let

C = cost of new machine;
c = salvage value of old machine;
d = accumulated depreciation on old machine;
H = hourly cost of new machine;
h = hourly cost of old machine;
P = hourly production of new machine, number of pieces;
p = hourly production of old machine, number of pieces;
A = annual production in number of pieces;
N = number of years required in which the new machine will pay for its installation.

The formula given reads:

$$\frac{C - c - d}{\left(\frac{h}{p} - \frac{H}{P}\right) \times A} = N$$

A typical example illustrating the use of the formula would be as follows:

$$\frac{6000 - 1000 - 3000}{\left(\frac{0.80 + 2.20}{12} - \frac{0.80 + 2.50}{20}\right) \times 25{,}000} = 0.94$$

or approximately one year.

In commenting on this formula, the authors stated that while simple, it does not correspond with the accounting methods and policies of some of the corporations using machine tools; and it gives credit for the value of an old machine that may or may not be sold at the figure estimated.

A factory cannot derive the full benefits and profits that spring from mechanical efficiency unless it keeps its machinery up to date, following the progress of invention closely and utilizing the very best and most modern devices that science makes available. This means that the men in charge of a manufacturing enterprise must be willing to junk things—to get rid of them summarily when they have outlived their usefulness; and they must calculate matters from the actuarial standpoint, as our insurance friends would say, estimating the live prospects in such a way that they can scrap outworn equipment without suffering any serious financial loss as a result. This is of vital interest to us consumers, because old machinery means higher prices to be paid by everybody.

The Machine Tool Builder's Problem

The most important problem that now confronts the machine tool builder, in as far as the automotive industry is concerned, is that of developing special machines that can be changed within certain limits without completely rebuilding the machine. In this way, required changes may be made in the design of automobile engines and other automobile parts without necessitating an entirely new set-up of shop equipment. What seems to be needed is machines that are more highly special than the ordinary standard machines, and yet more standard than the present type of special machines. The successful development of this idea might furnish a good deal of business to the machine tool industry and, at the same time, decrease the costs of the user of machine tool equipment.

In conclusion, the authors stated that the best formula for determining when new machinery should be bought is this: Replace present equipment whenever it costs money not to buy.

A Systematic Method of Buying Shop Equipment

In one plant, when it has been decided to buy new machines for some one department, blueprints and samples of the parts to be made on the machines are carefully studied by the company's production engineers to determine the method by which the work can best be done, and to decide upon the machines on the market that would be suitable for the job. Machines of at least four companies are tentatively selected. The builders of these machines are then asked to submit bids.

The manufacturers of the machine tools are given complete information as to what operations are to be performed and what the minimum rate of production should be. No suggestions are given as to how the company's production engineers have planned to do the work. It is considered that the machine tool manufacturers are specialists and may know about improved methods of holding the work, indexing it, taking simultaneous cuts, etc.—methods that may not have occurred to the company's own production men. Sometimes the seller's proposed methods are much better than those that the company's men have devised; sometimes they may not be so good, and in that case, the production engineers' own ideas are suggested to the prospective seller of the machine tool.

The methods of doing the work proposed by the machine tool builders are carefully examined by two production engineers who have no knowledge of the price quoted. In that way, they are able to decide upon what they consider technically to be the best method, irrespective of its cost. They also estimate how much more, in dollars and cents, the selected method is worth to the company per year than the next best; then, when the actual prices quoted are made known, it is easy to determine which machine is best from the standpoint of quality of product, production, and price.

New Shop Equipment

Latest Developments in Metal-working Machines, Small Tools, and Work-handling Appliances

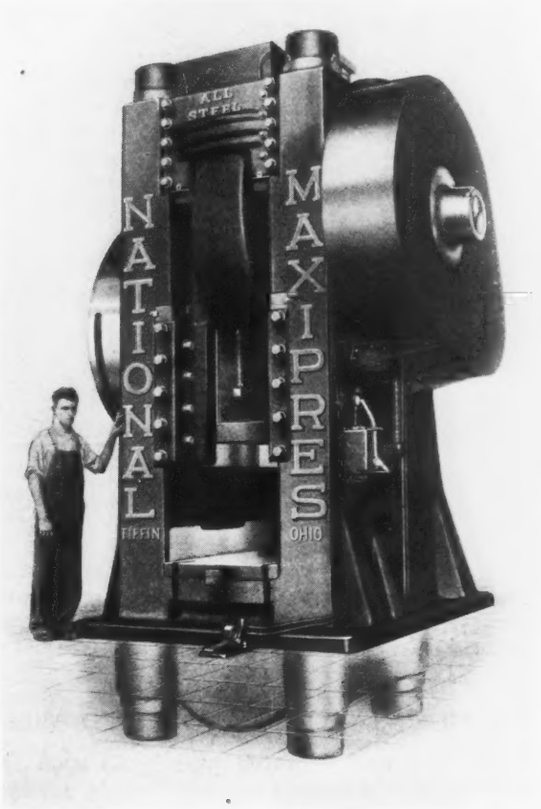


Fig. 1. Maxipres Coining Machine which Combines High Pressures with Fast Operating Speed

NATIONAL MAXIPRES COINING MACHINE

The so-called "coining process" eliminates the need of further machining operations in many instances, and may well be referred to as "machining to size by pressure." The process is not new, but the extreme pressures required for this work have heretofore confined the operation to comparatively slow-operating machines. The National Machinery Co., Tiffin, Ohio, however, has recently brought out a line of machines known as "Maxipres," which combine high pressures with a high operating speed. In addition to the high speed, it is claimed that the accuracy obtained is comparable to that secured by ordinary machining methods. This press is made in eight sizes, ranging from 19,000 to 368,000 pounds in weight.

The entire frame of the machine, including the base, crown, and columns, is a one-piece steel casting. All cross-members are cast integral. The frame is bored to receive four heavy tension bars, which are shrunk into position so as to place the frame under initial compression and add to the inherent stiffness of the design. The base and crown distribute the working loads to the tension bars without becoming deflected themselves. With this construction, it is possible to coin or form accurately to size, regardless of variations in the temperature of the work or of differences in the size of the original blanks.

There are only three bearings between the source of power and its application. Among the important features that have been taken from the "High Duty" forging machine built by the same concern, is the patented over-arm slide. This slide extends over and above the eccentric shaft, forming an extended pilot bearing, which gives increased area and support. The design makes possible a great reduction in the distance from the die-bed to the shaft, and this feature makes the machine unusually rigid.

The pitman is of the one-piece, non-adjustable type, means for adjusting the die height being located on the bed frame. The main shaft is of the full eccentric type. The upper main bearings support the shaft directly next to the side faces of the eccentric and close to the center line of the load, so as to place the shaft nearly in direct shear and thus permit it to carry heavy loads without spring or deflection. As shown in Fig. 2, the lower half of the shaft bearing housing is supported in the bed frame by a tapered wedge block, which is accurately fitted and which provides a convenient means of adjusting the main bearings.

The machine is controlled by a quadruple abutment clutch, which starts the press in a quarter revolution and an air trip, both of which have been used on the "High Duty" forging machine. The flywheel is of the National friction-slip design and protects the entire machine from damage due to stalling or

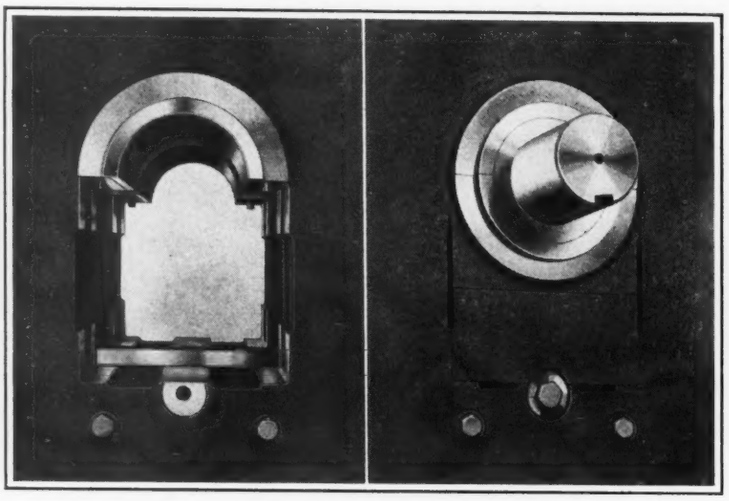


Fig. 2. The Lower Half of Each Main Shaft Bearing on the Maxipres is Supported by an Adjustable Wedge Block

misplaced work. Accurate vertical adjustments for the dies are obtained through a wedge on the base of the bed frame. Both the upper and lower die-sets are equipped with suitable knockouts which permit the work to be lifted out quickly.

PRODUCTO-MATIC LARGE-SIZED MILLING MACHINE

A larger and improved machine of the scissors type has been added to the line of Producto-Matic milling machines built by the Producto Machine Co., Bridgeport, Conn. In this No. 55 machine, the feeding arrangement is positive in all directions, there being three slides, one of which operates in a horizontal direction and the other two vertically. The vertical slides permit independent feeds to be used for the two cutter-spindles.

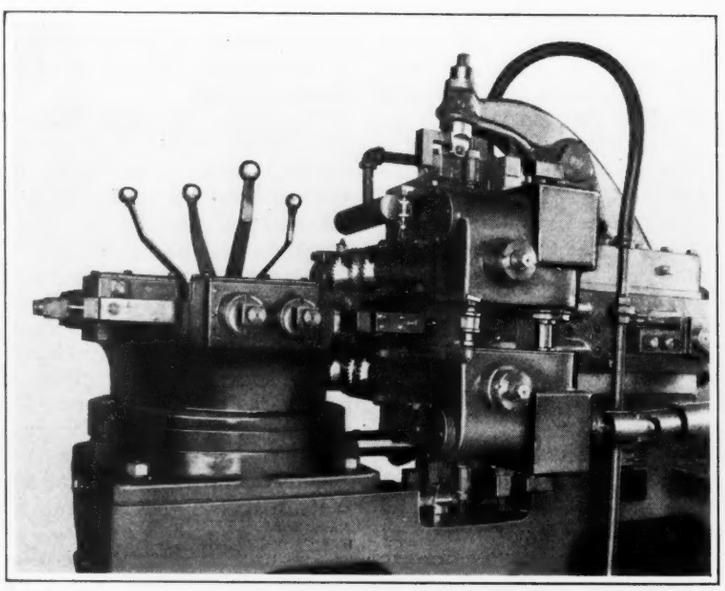
Each of the slides is operated by a cam. The horizontal slide engages the cam directly through a roll and an adjustable bracket, while the vertical slides are actuated by means of levers fulcrumed at the center. A roll at one end of each of these levers engages a cut templet, and at the other end there is a second roll that engages the cam. With this improved method of traversing the cutter-slides, no springs are employed, springs being used only for counterbalancing purposes. It is mentioned that the improved method of feeding the cutters has given the machine 50 per cent greater cutting capacity.

Unusual milling operations can be performed advantageously. For instance, by operating the cams and the cut templets in unison, milling cuts of different angles, radii, and contours can be taken. One slide can be operated at a shorter or longer stroke than the other, and by using different types of templets and cams, different angles and radii can be milled with each cutter-spindle. The machine is particularly adapted for milling parts that must be finished on both sides, such as automotive connecting-rods.

FARREL VERTICAL-ROLL GRINDING MACHINES

Two machines were built recently by the Farrel-Birmingham Co., Inc., Ansonia, Conn., for grinding the vertical rolls of a universal mill used in rolling heavy structural H-beams. These rolls are 42 inches in diameter by 18 inches face width, and have a surface that combines two tapers and a curve. The middle portion of the face is ground to a true radius and the sides to a taper usually of either 4 or 8 degrees. These machines have been installed in the new beam mill of the Illinois Steel Co., South Chicago, Ill. The illustration shows a front view of one machine with a dummy roll in place for test purposes.

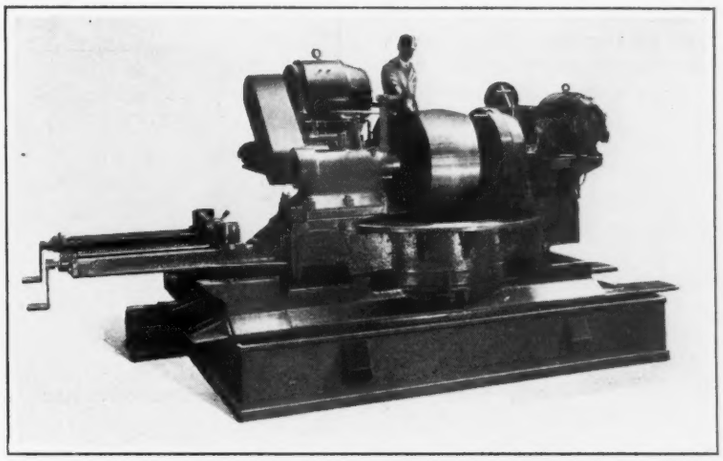
In addition to rolls with a maximum face taper of 12 degrees, straight-faced rolls can be ground. The grinding wheel is



Producto-Matic with Three Cutter-slides, One of which Moves Horizontally and the Other Two Vertically

30 inches in diameter by 3 inches face width. It is mounted on a heavy spindle provided with a lubricating system which is independent of all other oiling systems on the machine. Both a hand feed and power feed are available. The drive from the motor to the wheel-spindle is through multiple-vee belts. Speeds of from 575 to 1150 revolutions per minute are obtainable to suit reductions in the wheel diameter due to wear.

The headstock is of the dead center type, and is provided with a faceplate driven by means of double helical gears and a worm-gear reduction. The tailstock is provided with a sidewise adjustment, and is equipped with an indicator for locating the roll centrally with the carriage pivot. Traverse of the carriage is effected by a single worm-gear reduction driven by a variable-speed reversing motor.



Machine Built by the Farrel-Birmingham Co. for Grinding Rolls Used in Producing Structural H-beams

BROWN & SHARPE FORMED-WHEEL TRUING DEVICE

Three radii may be dressed on the sides and face of grinding wheels by means of a truing device recently designed by the Brown & Sharpe Mfg. Co., Providence, R. I. While built primarily for dressing a wheel that grinds a notch in the end of needle valves in the manner illustrated in Fig. 2, this device can be adapted for many other jobs.

It will be seen from Fig. 1 that the device consists of a base provided with a swiveling member. This base is bolted to the right-hand end of the machine table, where it does not interfere with the grinding operation. Three positions are provided for the swiveling member, in each of which one truing operation is accomplished. Bolted rigidly to the swiveling member is a former shaped to the required radius.

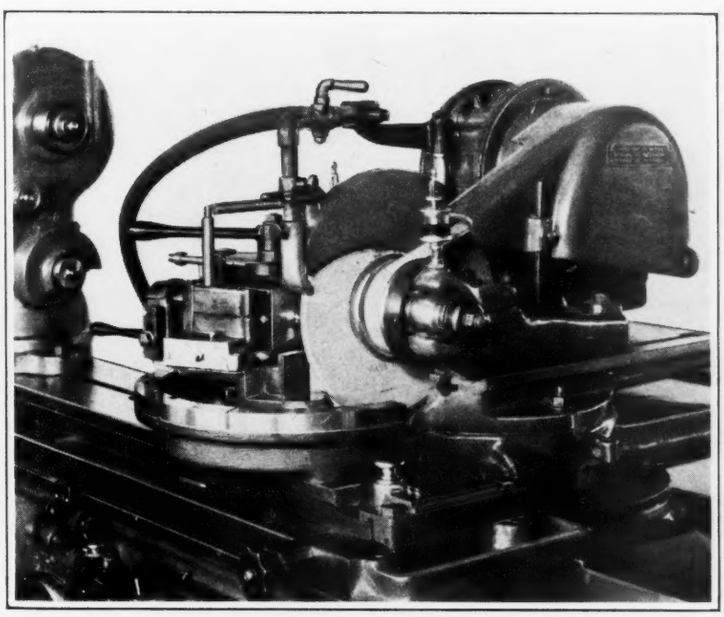


Fig. 1. Brown & Sharpe Attachment for Truing Sides and Face of Grinding Wheels to Three Radii

The diamond tool holder is carried on a pair of slides mounted on the swiveling member. These slides operate at right angles to each other to give both longitudinal and transverse movements to the diamond holder. By means of spring tension, a follower on the slides is kept in contact with the former. Thus, as the slides are moved back and forth by a hand-lever, the diamond travels in a path parallel with the contour of the former.

For truing wheels, the swiveling member is set in the central position, and then by means of a gage, the diamond point and former are adjusted into proper alignment. The diamond is next placed at approximately the center of the grinding wheel face by using the handwheel of the machine table, and the table stop is set so that the diamond can be easily relocated for subsequent truings.

The device is next indexed by a hand-lever to either the right- or left-hand position for dressing the corresponding side of the wheel. This is done by feeding the wheel in with the cross-feed of the machine and swinging the

diamond across the wheel by means of the upper hand-lever. When the dressing of one side has been completed, the cross-feed stop is set. The wheel is then moved away from the diamond, and the device is indexed for dressing the opposite side in a similar manner until the cross-feed operates against the stop. Finally, the swiveling member is indexed into the central position, the wheel is fed in, and the diamond is moved across the face until the face is dressed correctly. A second stop is then set for the cross-feed.

After the stops have once been set correctly, subsequent truings of the wheel can be readily accomplished by merely indexing the swiveling member into the proper positions.

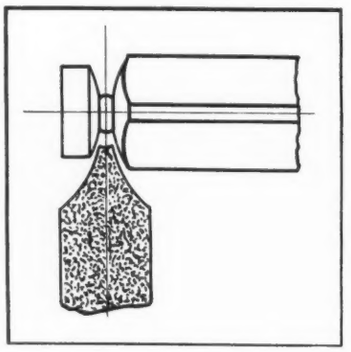


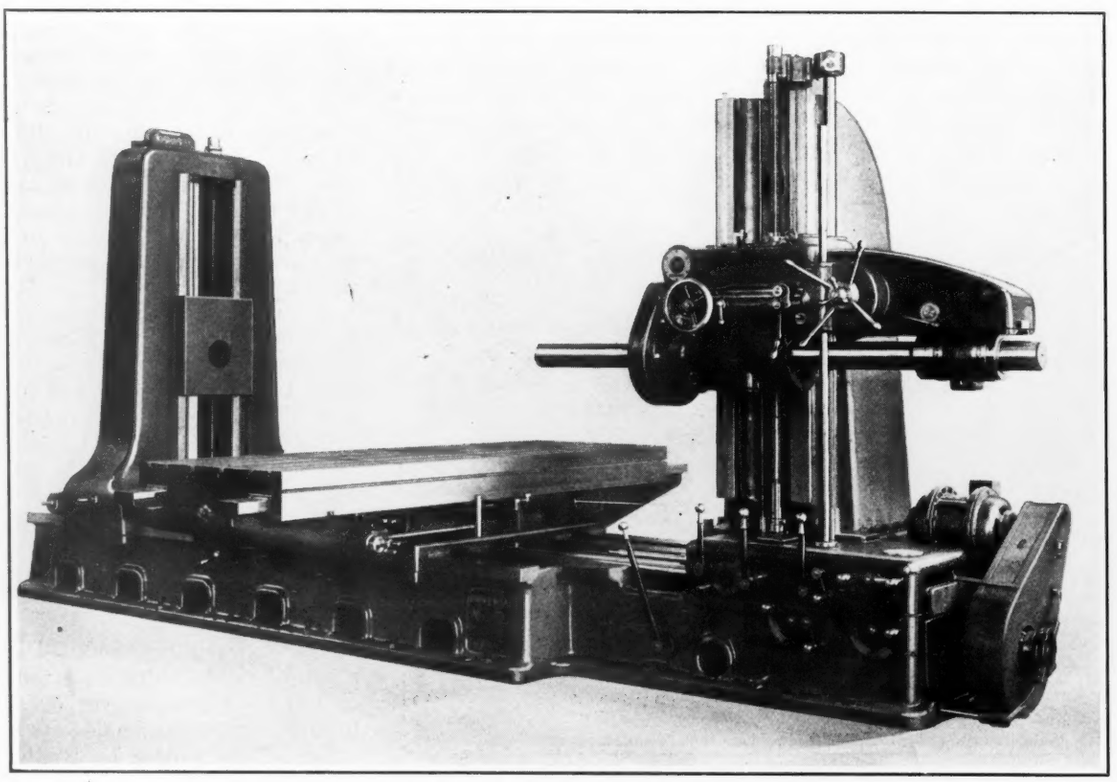
Fig. 2. One Use of a Grinding Wheel Dressed to Three Radii

LARGE UNIVERSAL BORING MACHINE

The largest machine ever built by the Universal Boring Machine Co., Hudson, Mass., is shown in the accompanying illustration. The distance from the faceplate to the outer support of the machine is 144 inches. The table is 40 inches wide by 120 inches long, and has a power cross-feed of 100 inches. The distance from the top of the table to the center of the bar is 50 inches. The main boring-bar is 5 inches in diameter, and is furnished with a No. 7 Morse taper socket. The net weight of the machine, without the motor, is 54,000 pounds. Beds with a distance of 168 inches between the faceplate and outer support can be provided, as well as tables up to 60 inches by 144 inches, with a power cross-feed of 120 inches.

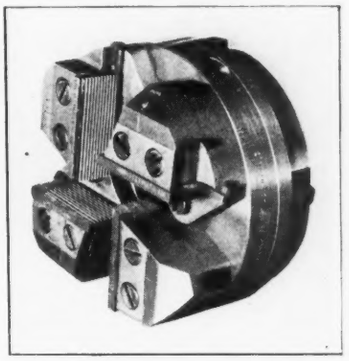
The bed is provided with four ways measuring 56 inches across the top. Of this width, 24 inches is bearing surface for the carriage. Openings for cleaning out the chips are provided at both the front and rear of the bed. Controls for the table and carriage are concentrated in a single bracket, from which the operator controls both the hand and power cross-feed for the table, the clamping of the table to the carriage, and the clamping of the carriage to the bed. Two cast-steel clamps, one at the front and one at the rear, are operated simultaneously for clamping the carriage to the bed. Lubrication of the machine is taken care of by a Bowen "one shot" oiling system in addition to a power-driven pump.

The heavy slide on the rear post assembly is counterbalanced



Horizontal Boring Machine Recently Built by the Universal Boring Machine Co.

by a weight inside the column. Vee ways are provided on both sides of the post to secure maximum rigidity. The slide can be clamped from the floor, regardless of the position of the bar with relation to the top of the table. The spindle sleeve is mounted in large precision-type Timken roller bearings, which make possible a maximum spindle speed of 400 revolutions per minute.



Landis Die-head Available in 3/4-, 2- and 4-inch Sizes

LANDIS "SOLID ADJUSTABLE" DIE-HEAD

The Landis Machine Co., Waynesboro, Pa., has placed on the market the "solid adjustable" die-head here illustrated, which is intended for application to various types of special automatic machines equipped with a power feed and head-reversing mechanism for threading pipe fittings and valves. This die-head is available in 3/4-, 2-, and 4-inch sizes. The assembly consists of four major parts made of high-carbon steel, heat-treated and ground.

Adjustments for size are effected by means of two screws. These screws lock the die-head with a rigidity claimed to equal that of a solid die. The patented Landis chaser is employed.

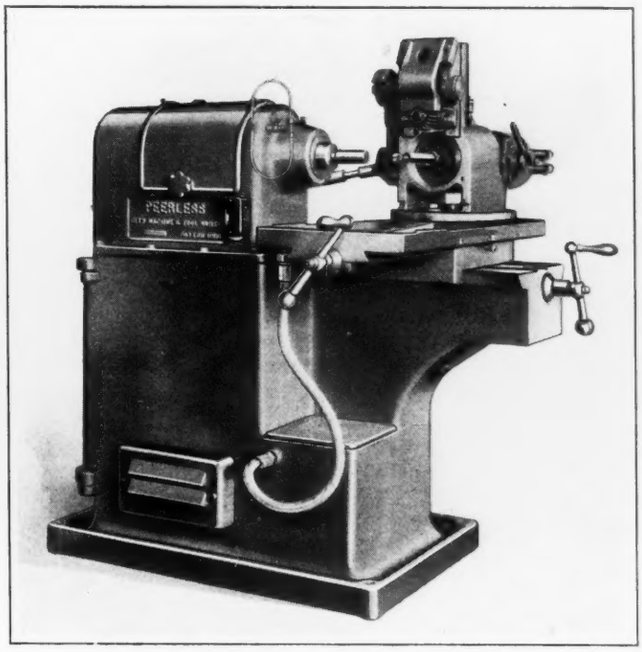
PEERLESS GEAR-TOOTH CHAMFERING MACHINE

A heavier and sturdier machine having a knee cast integral with the base has been added to the line of Peerless gear-tooth chamfering machines built by the City Machine & Tool Works, E. Third and June Sts., Dayton, Ohio. Other features of this new No. 3 machine include a fixed spindle mounting and a fixture head that is an integral part of the table. These and other improvements provide for greater production and increased rigidity.

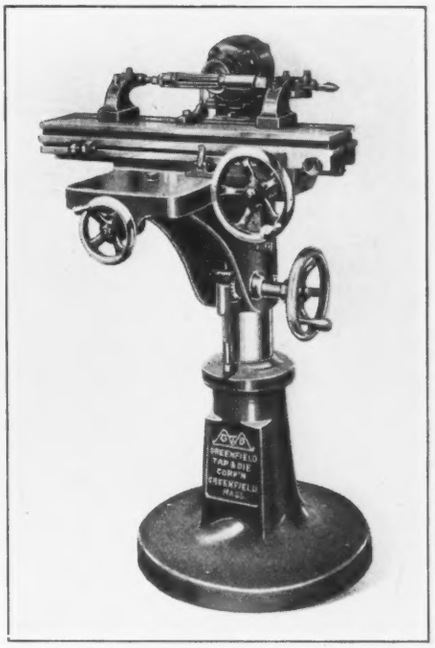
The cylindrical base of the fixture head can be swiveled as desired, and is graduated to facilitate setting the head to the proper angle with relation to the cutter-spindle. Instead of using vees for the sliding arm on which the work is moved back and forth from the cutter-spindle, the new machine incorporates a heavy arm that slides back and forth on a large bearing surface. This construction provides for longer life and more satisfactory performance at heavier feeds. The motor is mounted in the base.

GREENFIELD REAMER-GRINDING MACHINE

A reamer-grinding machine for service stations, replacement part jobbers, and garages, as well as for machine shops, has recently been placed on the market by the Greenfield Tap & Die Corporation, Greenfield, Mass. An interesting feature of this No. 4-R machine is that it can be adapted by the use of attach-



Peerless Gear-tooth Chamfering Machine



Greenfield Reamer-grinding Machine

ments for performing all the operations ordinarily handled on a universal cutter and reamer grinder, including cylindrical and internal grinding.

Attention is called to the fact that the work-table has a vertical movement in addition to a horizontal movement. The full length of the table rests on the longitudinal slide on which it swivels. There is a screw adjustment for swiveling the table to suit taper work, and such settings are facilitated by graduations representing taper variations in 1/8 inch per foot.

The base and column are made in one casting to provide rigidity. The knee is extra wide and has a long bearing on the column to which it is splined. The sleeve of the elevating handwheel is provided with graduations reading to 0.001 inch. Movement of the cross-slide is effected by a feed-screw, also equipped with a dial graduated to 0.001 inch. Longitudinal movement of the slide is obtained by means of a handwheel. Stops or dogs provide for limiting the stroke of the slide for shoulder work and also prevent the wheel from cutting into the shank of a reamer.

The wheel-spindle is mounted integral with an enclosed motor and revolves in ball bearings. The wheel-head can be conveniently swiveled to any desired angle with relation to the table through the use of graduations. The important specifications of this machine are as follows: Maximum distance between centers, 21 inches; swing over table, 6 1/4 inches; maximum distance from center of wheel-spindle to table, 8 1/4 inches; and net weight of machine, 475 pounds.

KELLER SMALL AUTOMATIC TOOL-ROOM MACHINE

Die and tool work up to 10 by 12 inches can be handled by a smaller size of automatic tool-room machine which has been added to the line built by the Keller Mechanical Engineering Corporation, 74 Washington St., Brooklyn, N. Y. This machine is made in two types, both of which are designed for accurately and rapidly milling dies of various types, such as trimming, blanking, piercing, progressive, or extrusion dies. This machine can also be applied to such work as cams, molds, punches, and any odd shaped parts that can be reproduced from master templets. One type is also provided with built-in jig-boring equipment to permit locating, drilling, and boring a number of holes precisely at one setting of the work. The jig-boring equipment includes horizontal and vertical vernier scales graduated to 0.001 inch, with magnifiers and lights.

This machine (see Fig. 1) is based on the same principles as the larger tool-room machines built by this concern. It is heavy enough to take "hogging cuts" and yet sufficiently sensitive to use milling cutters as small as 0.042 inch in diameter effectively. A groove 3/4 inch wide and 2 inches deep was milled "from the solid" in the part seen in Fig. 2 at one passage of the cutter. Spindle speeds from 225 to 3500 revolutions per minute are regularly available, and a super high-speed spindle can be supplied for operating at speeds of from 5000 to 10,000 revolutions per minute. This high-speed spindle is mounted in the regular spindle, but is driven by a separate motor.

A feature of the machine is an electric relay, which can conveniently be set to limit the power applied to the cutter, so that whenever the feeds place too great a load on the cutter, they are automatically stopped until the mill cuts itself free, when the feeds immediately start functioning again. Feeds can thus be set for obtaining maximum cutting speeds with the assurance that hard spots in the work will not break the cutter.

The cutter-spindle is guided by a simple electrical control as the tracer follows the outline of a templet placed on an angle-plate above the work (Fig. 2). Aside from occasional manual manipulation, as the general direction of the tracer movement

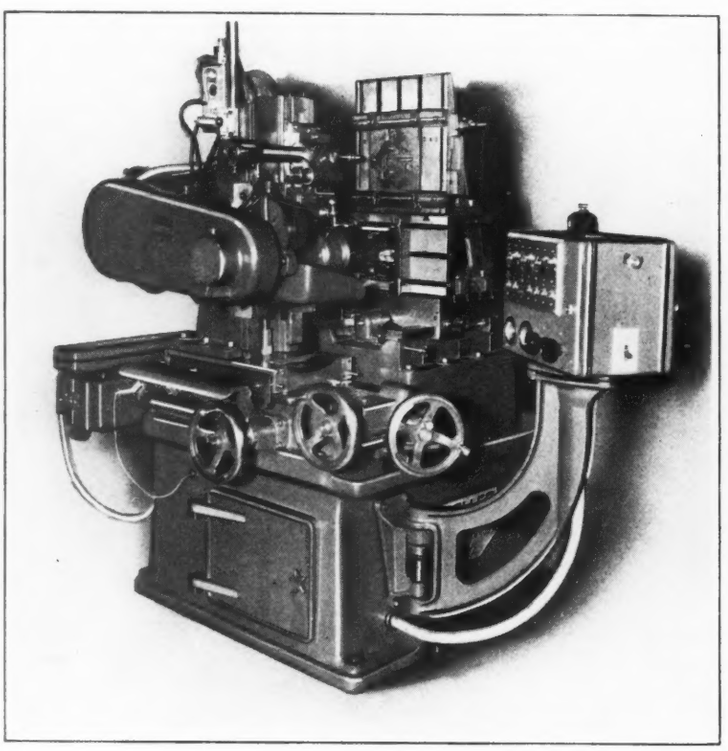


Fig. 1. Keller Automatic Tool-room Machine for Milling Small Dies and Tools and for Precision Jig Boring

changes from horizontal to vertical, or vice versa, this control is automatic. The cutter-spindle and tracer are carried on a slide which moves vertically on the column.

Horizontal movements are obtained by adjusting the column along the bed. Feeds from 3/4 to 1 1/2 inches per minute are available. In addition to the automatic means, the vertical and horizontal movements may be effected by handwheels. A handwheel is also used to adjust the work-table relative to the cutter-spindle and tracer. When the machine is arranged for jig boring, this transverse movement is power-operated. All electrical controls, with the exception of the one on the tracer head, are contained in a cabinet mounted on an arm pivoted to the base of the machine (see Fig. 1). This cabinet can be pulled toward the operator or pushed away, as desired.

An operation for which the machine is particularly well suited is the milling of punches integral with the flanges for attaching to the ram of the press. When dies are to be relieved from the back, both the work and templet can be turned over readily. Experimental tests have demonstrated that this machine will produce small dies and tools as efficiently as the larger Keller automatic tool-room machine, and with average savings often exceeding 50 per cent, as compared with ordinary toolmaking practice. The machine has a weight of about 5000 pounds.

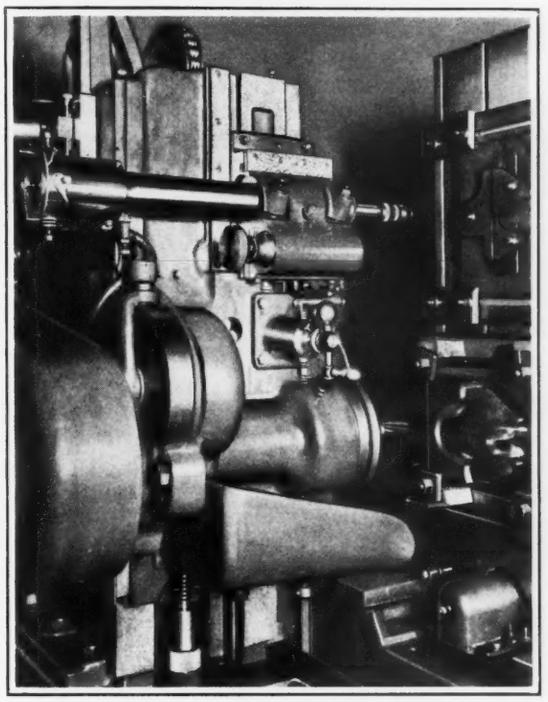


Fig. 2. Close-up View of Keller Machine, Showing Cutter, Work, Tracer Spindle, and Sheet-metal Templet

PUSH-BUTTON CONTROL FOR CRANES

The General Electric Co., Schenectady, N. Y., has brought out a new pendant type push-button for controlling small floor-operated cranes. This push-button is designed to supersede present rope and chain types of control. Among the advantages claimed are greater safety of the operator; a saving in time, since only one man is necessary to operate a crane; and reduced aisle space. The push-button station is of a size that can be readily grasped and operated by one hand.

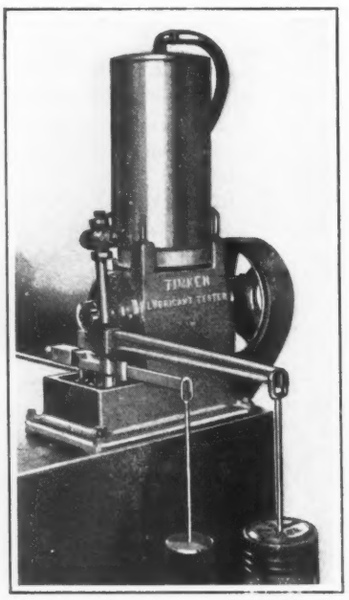
TIMKEN LUBRICANT TESTER

Apparatus for testing the load-carrying capacity of lubricants has just been announced by the Timken Roller Bearing Co., Canton, Ohio. Although originally developed for laboratory work, this apparatus is equally well adapted for use in industrial plants, power plants, or wherever it is necessary to determine accurately the efficiency of lubricants under given conditions of service. It can also be used to obtain data on the relative efficiency of different bearing metals under various conditions of load, speed, temperature, or with different lubricants.

The apparatus consists essentially of a cast-iron base which supports the testing mandrel, two levers, and a container holding about a gallon of the lubricant to be tested. The oil is heated to any desired temperature up to 210 degrees by an electric heater and flows by gravity from the container over the testing piece to a sump in the base, the rate of flow being adjusted by a valve. From the sump the oil is pumped back to the tank by a small pump in the base, which is driven by a belt from the testing mandrel. The testing mandrel is mounted in two Timken roller bearings and may be either direct- or belt-driven by a small variable-speed motor. A taper cup of a Timken bearing mounted on the end of the mandrel forms one of the test pieces.

The lever system, which is the most important part of the device, consists of two levers, one above the other. The upper lever is called the "load lever" and the lower one the "friction lever." The upper lever, which carries the hardened and ground test block, is pivoted on a knife-edge mounted in the lower lever. The latter is also pivoted on a knife-edge, and is provided with a stop at the unloaded end. Thus the test block is always parallel to the revolving cup and the "unit loading" over the length of both pieces is constant.

Assuming that both testing pieces are in place, the driving motor or lineshaft is operated up to the desired speed, and the lubricant heated to the required temperature and allowed to flow over the test block. Weights are then applied to the loading lever until the desired unit pressure is obtained between the test pieces. A chart is furnished which gives the weights required on the loading lever per 1000 pounds of unit pressure. If only the load-carry-



Timken Tester for Lubricants and Bearing Metals

ing capacity of the oil is to be determined, the test block is removed after running 30 minutes and examined for signs of "scuffing." The degree of scuffing determines the relative load-carrying capacity of the lubricant.

If the coefficient of friction of a lubricant is to be determined, weights are added to the friction lever until it moves away from the stop. Loading the upper lever causes the friction on the test block to move it forward horizontally, unbalancing the friction lever until it rests on the stop. This condition is compensated for by adding weights on the friction lever until the system is again in balance and the lever is off the stop. The coefficient of friction of the lubricant is then calculated from the weight required to balance the levers.

In case bearing metals are to be tested, either the test block or the cup or both can be made of the material to be tested. The friction lever is provided with a vernier scale and a sliding weight for obtaining accurate measurements, and both the levers are equipped for carrying adjustment weights. A welded steel housing covers the end of the mandrel and levers.

SPARKING-OUT ATTACHMENTS FOR HEALD GRINDING MACHINES

On internal jobs requiring a high degree of finish, a certain period of time is required after the feed of the machine has been discontinued for the wheel to "spark out." This sparking out is the natural dying out of a transverse pressure built up between the wheel and the work by the in-feeding function, and takes the form of a minute spindle deflection. Taking advantage of this condition, the Heald Machine Co., Worcester, Mass., has developed attachments for the Gage-Matic and Size-Matic internal grinding machines that automatically interrupt the cross-feed and allow sufficient time for the pressure in the spindle to dissipate itself naturally as the wheel is reciprocated in the bore of the work. These attachments aid in producing accurate and finely finished holes.

On the Gage-Matic grinding machine, the hole is rough-ground in the usual manner. When the roughing gage enters the work, an electrical contact is made, which actuates the electromagnet seen on the cross-slide unit in Fig. 1, disengaging the feed pawl from the ratchet and holding it out of engagement throughout the finishing cycle. In other words, the cross-feed is automatically disengaged after roughing, and the hole is brought to size by the pressure between the wheel and the work.

The time required for the sparking out is governed by the amount of stock left in the hole after roughing and the adjustment of the truing diamond. A micrometer diamond unit provides for fine adjustments.

The sparking-out attachment for the Size-Matic grinding machine consists of a time relay, mounted on the machine, which regulates the sparking-out time, and a cam attached to the top of the fine-feed cam on the handle which stops the feed just

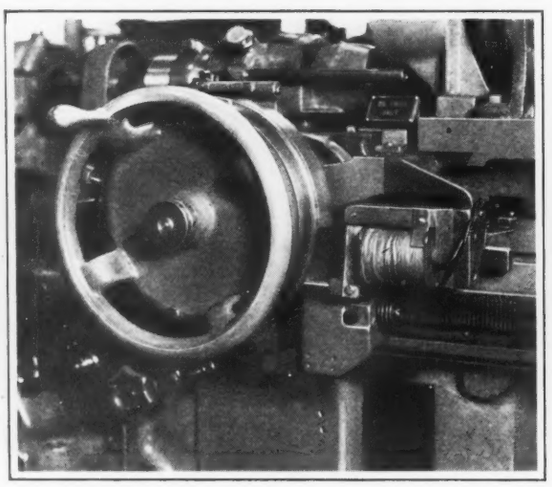


Fig. 1. Sparking-out Attachment on a Gage-Matic Internal Grinding Machine

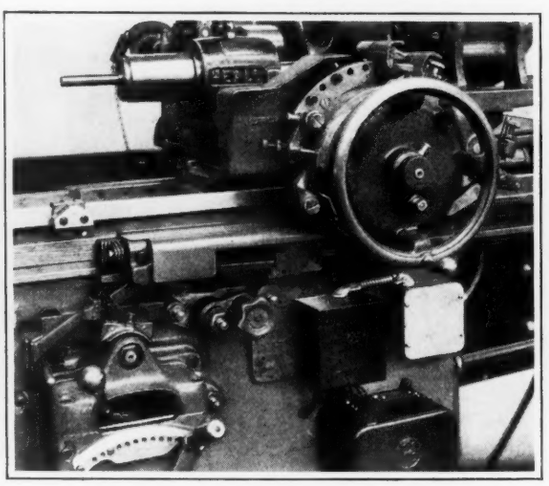


Fig. 2. Time Relay and Additional Cam Provided on a Size-Matic Internal Grinder

after the finish contact is made on the handwheel. These appliances may be seen in Fig. 2. The machine operates in the usual manner, except that when the finishing contact is made, the time relay is engaged instead of the table dog being tripped, and the grinding wheel then continues to reciprocate in the work without feeding. After a predetermined length of time, the time relay trips the table dog.

For extremely accurate jobs, when production is disregarded in order to obtain maximum finish, Gage-Matic grinding machines can be provided with a time relay similar to that used on the Size-Matic machine, as well as a backing-off attachment that lifts the wheel from the ground surface before withdrawal. The backing-off attachment can also be supplied for Size-Matic machines.

KEARNEY & TRECKER TUNGSTEN-CARBIDE MILLING CUTTERS

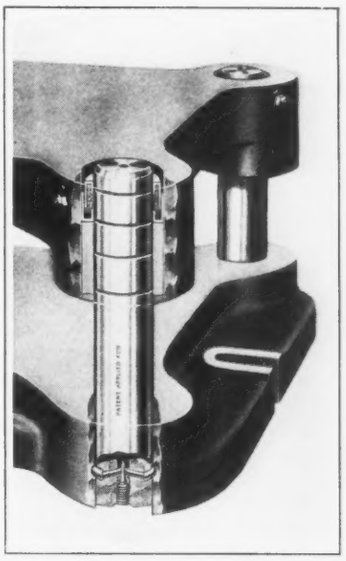
Face milling cutters with cemented tungsten-carbide blades are being placed on the market by the Kearney & Trecker Corporation, Milwaukee, Wis. These cutters are known as the "Full-Back" blade type, because each blade is provided with a solid positive contact along its entire back face with a view to providing the strength and rigidity necessary for the high cutting feeds and speeds that may be employed with tungsten carbide.

Instead of the blades projecting beyond the face of the cutter body, which is the usual practice, they are set practically flush with the body face. Chip clearance is provided by cutting slots in the body for the individual blades. Each blade is made with a tapered face, and is held in place by a wedge having a corresponding taper, this construction being similar to that used on the Kearney & Trecker milling cutters described in November MACHINERY. Hardened screws hold the wedges in place.

The tungsten-carbide cutters can be furnished in sizes ranging from 5 to 14 inches in diameter, either left- or right-hand, and with blades applicable for medium and semi-roughing or finishing cuts. Their design suits the milling of cast iron, semi-steel, malleable iron, bronze, copper, and aluminum.

DEMOUNTABLE LEADER PIN FOR DIE SETS

The E. A. Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill., has developed a quickly demountable leader pin with a locking device for use with power press die sets. As illustrated, the new leader pin is fitted at the lower end with three studs, a pressure spring for retaining the studs, and a hollow-head, cone-point locking screw.

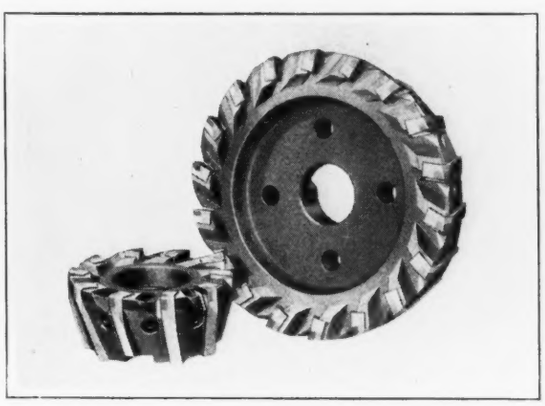


Die Leader Pin which is Readily Locked in Place or Disassembled

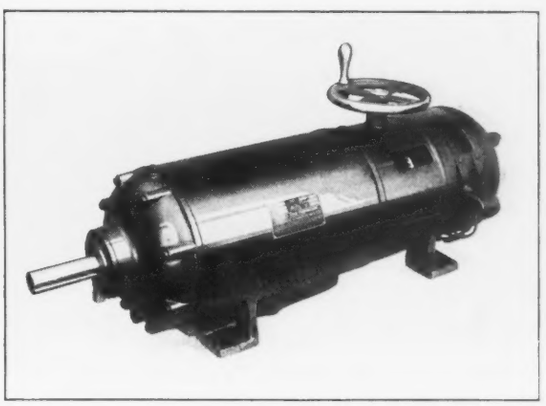
By turning the locking screw with a socket wrench, the three studs are made to expand the pressure spring into a recess in the die-shoe. To remove the leader pin, the locking screw is simply turned in the reverse direction to permit the pressure spring to contract. It is claimed that no matter how often this leader pin is removed from a die-shoe, positive locking and true alignment are insured.

STEPHENS-ADAMSON VARIABLE-SPEED DRIVE

In the variable-speed drive here illustrated, which has just been designed by the Stephens-



Kearney & Trecker "Full-Back" Blade Tungsten-carbide Face Mills



Stephens-Adamson Variable-speed Drive with Motor Assembled in the Same Housing

Adamson Mfg. Co., Aurora, Ill., the driving motor, speed changer, speed reducer, and control are combined in a single housing. Compactness is, therefore, one of the principal features of this drive. It is made in sizes to deliver from 1/4 to 7 1/2 horsepower. The motor section is usually wound to operate at 1200 revolutions per minute, and the drive will deliver power at any speed between 24 and 144 revolutions per minute or 120 and 720 revolutions per minute. The output speed is increased or decreased while the machine is in motion by simply turning the handwheel on top of the housing.

All moving parts, with the exception of the output shaft, are completely enclosed. The unit can be mounted on a machine in any position by means of four bolts. The drive is essentially the standard JFS type of variable-speed reducer with the housing modified to take the body of an electric motor. The motor armature shaft forms the high-speed shaft of the speed changer, thus eliminating the usual coupling between shafts.

The operation of the speed-changer section is similar to that of a large roller bearing in which the rollers and races are ground to a special shape. Power is transmitted by the traction between the polished surfaces of the rollers and races, it being claimed that the transmission is absolutely positive under loads within the rated limits.

MOORE DRILLING AND LAYING OUT EQUIPMENT

A device designed to facilitate the accurate spacing and drilling of holes in such parts as master plates, templets, and jigs is being placed on the market by the Moore Special Tool Co., Inc., Bridgeport, Conn. As may be seen in the illustration, the equipment consists of a drill bushing mounted on a small slide that is graduated in fortieths of an inch, the slide carrying a vernier plate. The small slide, in turn, is mounted on a large slide that is graduated in the same manner. When both slides are set so that the reading of their scales is 4 inches, the drill bushing is in line with the axis of the table.

The table is an 8-inch disk that can be set to any angle, and the settings can be read to one minute. The right-hand knob on the front of the device operates a plunger to locate the table in any 90-degree position; the center knob controls a micrometer adjustment for positioning the table to other angles; and the left-hand knob is used to clamp the table after it has been set.

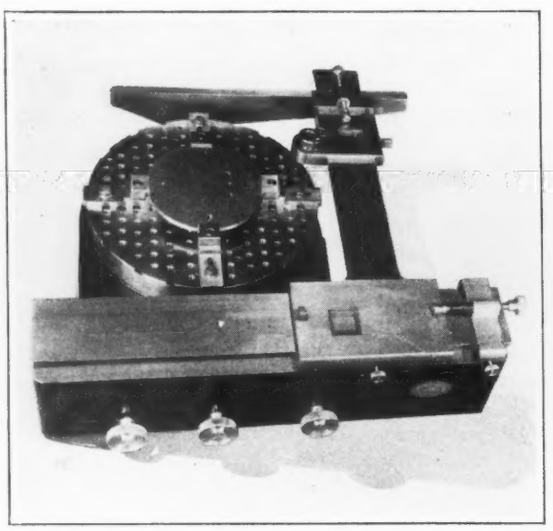
It is claimed that with this equipment holes can be drilled and reamed to prescribed center distances within the limits of plus or minus 0.00025 inch, and that the time required for producing holes ranges from 2 to 5 minutes, according to their size and the thickness of the work. Lines can also be scribed and prick-punches accurately positioned on work.

CALCULATION CHART FOR ARITHMETICAL PROBLEMS

A chart for obtaining answers to problems in multiplication, division, reciprocals, squares, and square roots almost at a glance for numbers up to three places has been devised by Walter G. Hawley, Rock Glen, N. Y. The charts, which are placed on the market by Mr. Hawley for use in drafting-rooms and engineering offices, are 6 by 6 inches and are ruled with cross-section and diagonal lines. Directions for using are given on the back.

RANSOHOFF PLATING EQUIPMENT

A plating barrel which is loaded and unloaded automatically has recently been built by N. Ransohoff, Inc., Cincinnati, Ohio. As may be seen in Fig. 1,



Equipment Designed to Facilitate the Accurate Laying out and Drilling of Holes

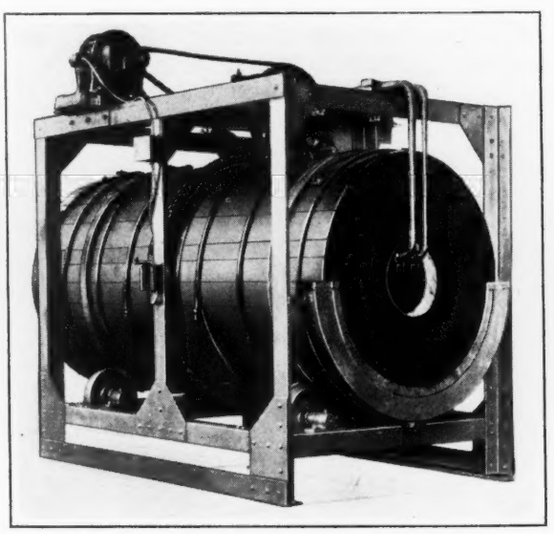


Fig. 1. Ransohoff Plating Barrel which is Loaded and Unloaded Automatically

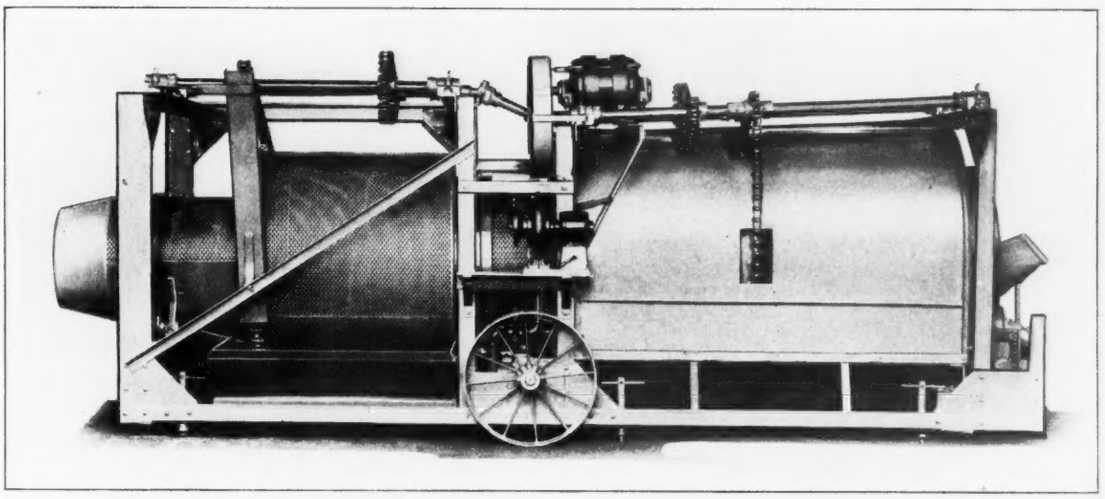


Fig. 2. Equipment Designed for Removing Excess Zinc from Parts and Discharging Them Dry

this barrel consists of a drum made of 3-inch maple. It is divided in the middle section by a diaphragm of rubber-covered steel. A Formica screen at the center of the diaphragm extends to the discharge end of the drum. Anodes and cathodes hang from two bars that extend into the barrel from the charging end.

The diaphragm is so arranged that when the barrel is rotated in one direction, the work is held in the plating chamber and is gently agitated in the plating solution. When the barrel is rotated in the opposite direction, the work is automatically discharged into the Formica screen, the excess solution drains off, and the work emerges at the end of the barrel. It is intended that the barrel be mounted over a rubber-lined tank which holds a certain amount of plating solution and that this solution be constantly circulated by a pump through a filter and into the plating barrel.

Fig. 2 shows equipment recently built by the same company for removing the excess zinc from galvanized parts. The first section of this equipment is a slanting hooded barrel that is gas-heated. The barrel is made of perforated metal, its angle is adjustable, and it revolves at 50 revolutions per minute. As the work passes through, the excess zinc is removed and reclaimed in a chute beneath the hood. The parts then travel into a larger drum and are revolved slowly in water. This process quenches, but does not cool the parts; they are discharged dry.

NOYES SEMI-FINISHED TOOL BITS

A line of semi-finished tool bits in five sizes ranging from 5/16 inch by 2 3/4 inches long up to 5/8 inch by 4 3/4 inches long is being placed on the market by the Noyes Tool Sales Co., Bridgeport, Conn. In making these bits, special cutting-off equipment is employed which cuts the bits from the bar stock at an angle of 30 degrees. This feature adds from 5 to 18 per cent to the usable length of the tool bit. The amount of grinding required to finish the cutting ends to shape is also reduced from 50 to 90 per cent.

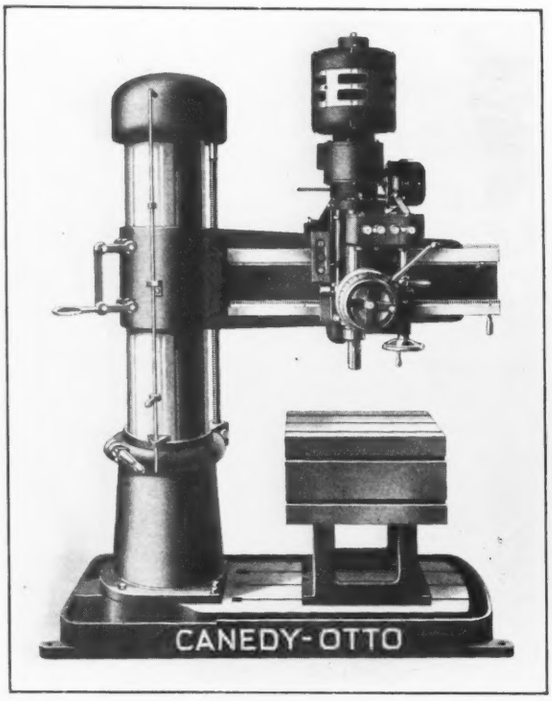
CANEDY-OTTO RADIAL DRILLING MACHINE

The spindle of a 3-foot radial drilling machine recently developed by the Canedy-Otto Mfg. Co., Chicago Heights, Ill., is driven direct by a vertical motor mounted on the head. This construction makes it possible to obtain four spindle speeds without the use of gears, the motor being of the variable-speed type. Four additional speeds are available through back-gears to suit heavier cuts. The spindle speeds range from 85 to 1750 revolutions per minute. A drum control on the head permits instant changing of the motor speeds, while a single lever is operated to change the speeds obtained through the back-gears.

Another advantage of this drive is that, since the motor is of the reversing type, tapping can be performed without special equipment. By means of a push-button control, the spindle can be started, reversed, or stopped instantly.

Four feeds are available through a gear-box at the front of the head. A ratchet clutch lever makes it possible to disengage the power feed mechanism for feeding by hand. A large graduated dial permits accurate reading of drilled depths, and there is an automatic trip-bar for self-feeding.

The column of the machine rotates on annular ball bearings and Timken tapered roller bearings. Two sets of Timken bearings are also furnished for the spindle, and the motor is of ball-bearing construction. The vertical arm is moved by an individual motor mounted on top of the column. Safety trips are provided at the top and bottom to stop the motor. A double ten-



Canedy-Otto Radial Drilling Machine with Spindle Driven by Reversing Motor

Handling a Die with a Lifting Machine Built by the Economy Engineering Co.

sion mechanism secures the arm in place for drilling. The head saddle travels on ball-bearing rollers. A travel of 3 3/4 inches per revolution of the handwheel expedites the movement of the spindle over the work.

The important specifications of this machine are as follows: Maximum distance from spindle to base, 50 inches; minimum distance from spindle to base, 11 inches; minimum distance from spindle to column, 11 inches; traverse of spindle, 10 inches; traverse of head on arm, 27 inches; and weight, 3000 pounds. The machine will drill to the center of a 72-inch circle.

ROBBINS & MYERS BOX-FRAME MOTORS

A new line of box-frame motors comprising sizes of from 1/2 to 3 horsepower is being introduced on the market by Robbins & Myers, Inc., Springfield, Ohio, and Brantford, Ont., Canada. These motors are of compact construction and have semi-enclosed end heads. An improved wool-yarn bearing lubrication system is standard, but ball-bearing motors of identical types can be built to special order. The mounting dimensions are the same as for other types of motors made by this company.

BALL-BEARING EQUIPPED LIFTING MACHINES

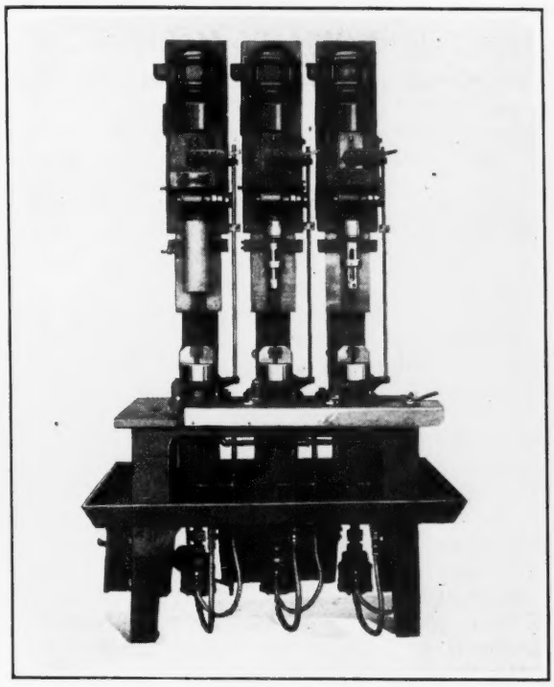
Hand- and power-operated ball-bearing equipped lifting machines, in both plain and telescoping types, have recently been developed by the Economy Engineering Co., 2653 W. Van Buren St., Chicago, Ill. Ball bearings are used throughout the gearing and in the sheave and platform-frame wheels of these machines. On the telescoping types, the sliding-frame wheels are equipped similarly.

These machines find application in machine shops for handling dies, jigs, and other heavy parts or units. They are made regularly in capacities ranging from 500 to 2000 pounds, but special machines can be built for lifting loads up to 10,000 pounds.

The illustration shows a lifting machine having a capacity of 2000 pounds. It is 9 feet 1 inch high over all, and will lift platforms 6 feet above the floor. This equipment is arranged with a separate winch and cable, in addition to the regular hoisting unit, for removing dies from racks or power presses. An automatic lock binds the equipment solidly to the floor to prevent it from moving as a die is pulled on the platform. The steering lever automatically raises the equipment off its feet when an effort is made to move the machine.

LANGELIER CAP-SCREW SQUARING UP AND ROUNDING MACHINE

A semi-automatic machine designed for squaring up under the head of cap-screw blanks and for rounding the end to be threaded was recently built by the Langelier Mfg. Co., Prov-



Semi-automatic Machine for Squaring up Under the Head of Cap-screw Blanks and Rounding the End to be Threaded

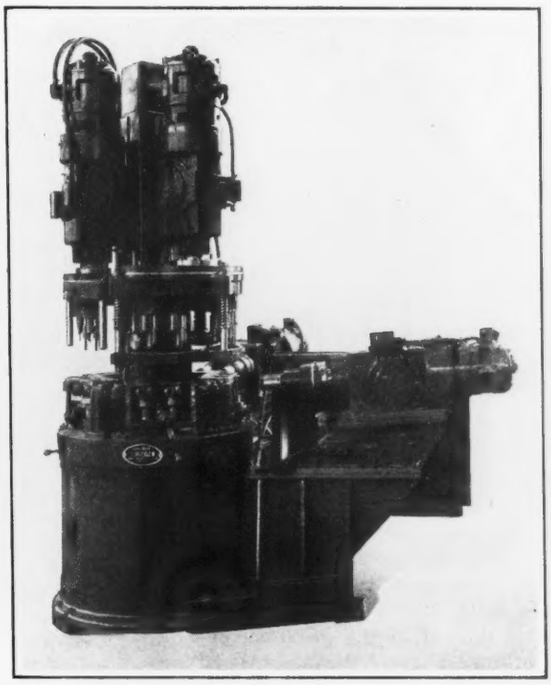


Fig. 1. Ex-Cell-O Machine Designed to Perform Various Operations on Steering-gear Cases at One Loading

idence, R. I. The cap-screw blanks are made of nickel steel, the head being produced by upsetting. All sizes of screw blanks from 1/4 inch in diameter by 1 inch in length up to 5/8 inch in diameter by 6 inches in length can be accommodated.

As may be seen from the illustration, three Langelier No. 21 automatic units are mounted vertically on individual columns bolted to the table and leg assembly. Each unit is equipped with a special tool having inserted cutters that may be adjusted for any diameter and length of screw within the range of the machine. The tools are designed to deliver cutting compound in such a manner as to wash out the chips. Each unit is driven by an individual motor.

The work is held in two-jaw chucks having inserts that grip the head and leave a sufficient portion projecting to allow for squaring up. Each chuck is air-operated through the medium of a cylinder and draw-rod controlled by a valve lever located on the table. This lever also controls another air cylinder for raising the chuck into the working position, which is governed by an adjustable stop.

After the head of a screw has been inserted in the opened chuck jaws, the valve lever is moved to the pressure side to grip the screw and elevate the chuck into the working position. The shank of the screw extends upward inside the tool. The tool is now fed in to the work and then returns rapidly to its original position. Finally, the operator moves the valve into the exhaust position, the work is lowered rapidly, and the chuck jaws opened. The production of each spindle is ten pieces per minute.

EX-CELL-O DRILLING, REAMING, COUNTERBORING AND TAPPING MACHINE

All the holes in the steering-gear case shown in Fig. 2 are finished at one loading in the semi-automatic machine illustrated in Fig. 1, which was built by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. It will be noticed that these holes vary in size and location and that some are at right angles to others. The machine drills and reams two holes; drills, countersinks, and taps three holes; counterbores the large recess in the top face; and rough- and finish-counterbores the hole in the barrel end. The operator merely loads and unloads the parts without starting or stopping any of the units.

Three multiple-head units are mounted on the vertical column of the machine, and two additional multiple units are located horizontally at the side. All units are operated by individual motors. Five fixtures, holding two parts each, are mounted on an automatic rotating table beneath the vertical heads.

At the first station, the large recess is counterbored by a vertical unit and the long hole is rough-counterbored by one of the side units. Five holes are drilled in each part at the second station, four being drilled in the flat face, while the fifth is located in the bottom of the piece. The long bore is finish-counter-

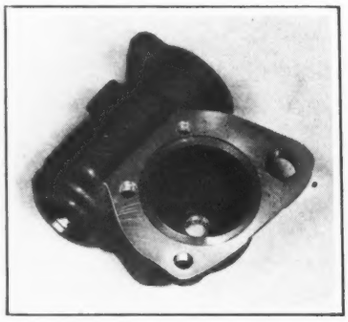


Fig. 2. Part Drilled, Reamed, Counterbored, and Tapped in the Machine Shown in Fig. 1

bored simultaneously by the second side unit.

At the third station, three holes are countersunk in each of the parts and two dowel-holes are reamed, these being the five holes drilled in the previous operation. Three holes are tapped in each part by the vertical head at the fourth station. Each vertical head is equipped with pilot bars guided by bushings in the fixtures, and the side units are guided by roller pilots.

The machine is electrically synchronized so that the rotary table cannot be indexed unless all units are in the back position. When all units are in this position, the table indexes automatically and then the units start moving toward the work pieces. The machine can be started or stopped from either the front or rear by means of three sets of control buttons. These permit convenient operation of the machine when the various tools are being adjusted.

MILFORD DUPLEX HACKSAW BLADE

A feature of the Milford duplex hacksaw blade recently placed on the market by the Henry G. Thompson & Son Co., New Haven, Conn., is the provision of 2 1/2 or 3 inches of fine teeth at the forward end of the blade to facilitate starting the cut. This blade is made in hand frame sizes with 14 to 18 teeth to the inch. The product is patented, and is obtainable in different styles to suit various requirements.

WADKIN JR. PATTERN MILLING MACHINE

A pattern milling machine designed for use in the smaller plants has been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. This machine was developed by Wadkin & Co., Leicester, England, and is built along the lines of the larger universal pattern milling machine manufactured by the same concern.

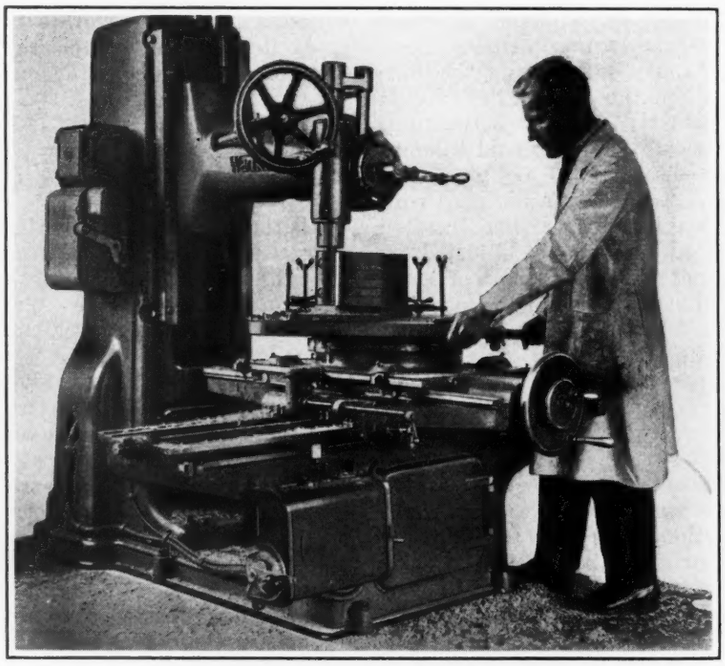
From the illustration it will be seen that an overhanging arm slides on a column. This arm carries a spindle head and is raised and lowered by turning a large handwheel. The distance between the center of the cutter-spindle and the column face is 28 inches.

The spindle head can be swiveled from a vertical to a horizontal position, graduations being provided for setting it to different angles. A taper spring plunger engages holes for accurately locating the head at any angle, and it is locked in position by a handle. When the spindle is in the horizontal position, the maximum distance from the work-table is 18 inches. When the spindle is vertical, this dimension is 15 inches.

The spindle is fed to the work by means of a hand-lever. Power is transmitted to the spindle through a shaft running the full length of the arm. Two spindle speeds of 4300 and 2700 revolutions per minute are available to suit various sizes and types of cutters. Through the use of a simple attachment, patterns with gear teeth can be quickly cut.

TUTHILL OIL-PUMPS

Two pumps intended both for handling lubricating liquids and for transmitting power hydraulically are being placed on the market by the Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill. The Model CP pump illustrated is of the rotary internal-gear positive-delivery type. It is equipped with an improved stuffing-box and ball bearings which absorb the thrust and radial loads of the rotor. A new standard mounting design makes it convenient to incorporate this pump in a machine inconspicuously and in a minimum of space. A bracket of the construction shown at the left can



Pattern Milling Machine Designed to Meet the Requirements of the Smaller Shops

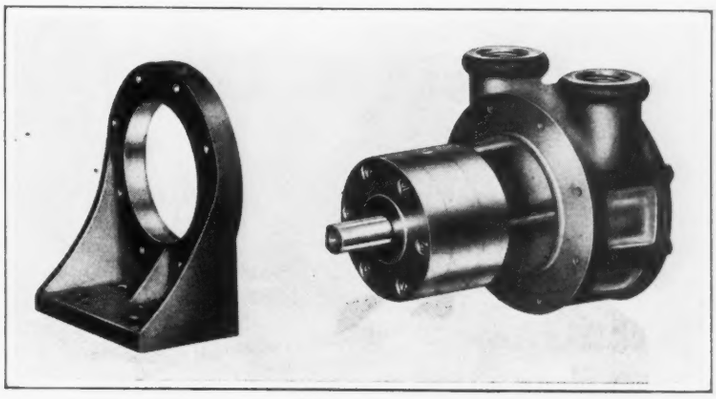
be provided for a foot type of mounting if desired.

This pump is available in four sizes, ranging in capacity from 2 gallons per minute at 300 revolutions per minute to 40 gallons per minute at 1200 revolutions per minute. Pressures up to 200 pounds per square inch can be developed.

The same concern has brought out a Model L rotary pump, which is also of the internal-gear positive-delivery type. This pump is provided with a mechanical seal, which eliminates packing and thus prevents trouble from the motor becoming overheated by improper packing adjustments. It is arranged primarily for end mounting, but, like the Model CP pump, can be provided with a bracket for foot mounting.

Six sizes of this pump are available, ranging in capacity from 3 to 180 gallons per hour. Speeds up to 3600 revolutions per minute are obtainable in the smaller sizes, and up to 1800 revolutions per minute in the larger sizes.

Pressures up to 200 pounds per square inch can be developed with the larger sizes. The bores are ground to permit small clearances and, therefore, higher pressures. This pump can be mounted above the level of the liquid being pumped, as it has a high suction lift. In addition to the other applications, it can be used in oil-burning installations.



Tuthill Ball-bearing Pump Intended for Hydraulic Power Transmission or for Handling Lubricating Liquids

FITCHBURG AUTOMATIC CONTINUOUS DRILLING MACHINE

A machine designed for the automatic continuous drilling of small holes in such parts as clevis pins and spring bolts has been brought out by the Fitchburg Grinding Machine Corporation, Fitchburg, Mass. The work is fed from a hopper to automatic clamping fixtures, where the holes are drilled and countersunk, when desired, and then the parts are ejected. The operator need only keep the hopper filled and the drills ground.

Parts of the same diameter, but of different lengths, can be handled with little change in the tooling and fixtures, but other parts require different fixtures and loading devices. In equipping a machine for a number of different jobs, the in-feed cam of the drill spindles is set to suit the maximum thickness of work to be drilled. Thus the cam need not be changed.

As may be seen from Fig. 2, there are eight ball-bearing drill spindles arranged horizontally in a rotating drum. Around this drum is a stationary ring cam which feeds the drill spindles as the drum revolves. Drill speeds can be changed through pick-off gears at the end of the machine. The fixtures are clamped on a turret mounted on the drum shaft and rotate in alignment with the drill spindles. The fixtures are clamped automatically by a stationary cam.

The countersinking attachment is located in front of the unloading turret and both ends of a hole are countersunk by two opposed spindles. These spindles

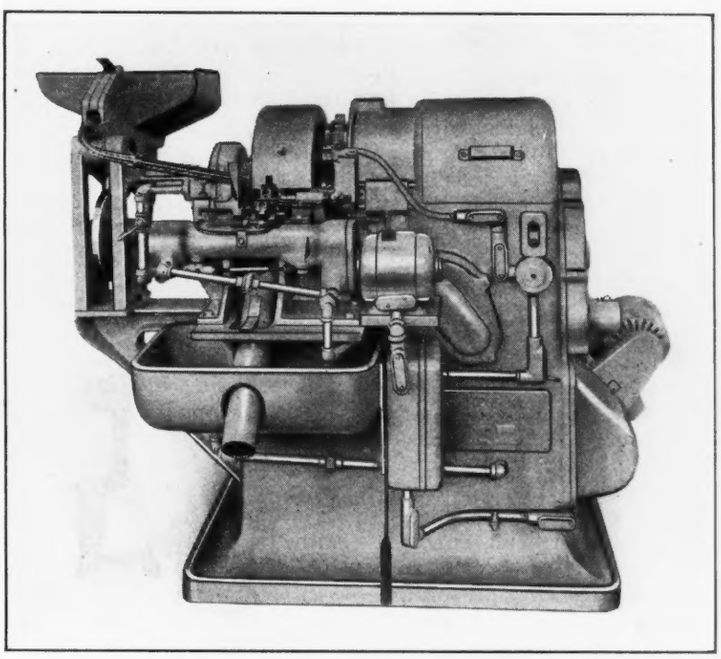


Fig. 1. Fitchburg Machine Designed for the High-speed Drilling and Countersinking of Small Holes

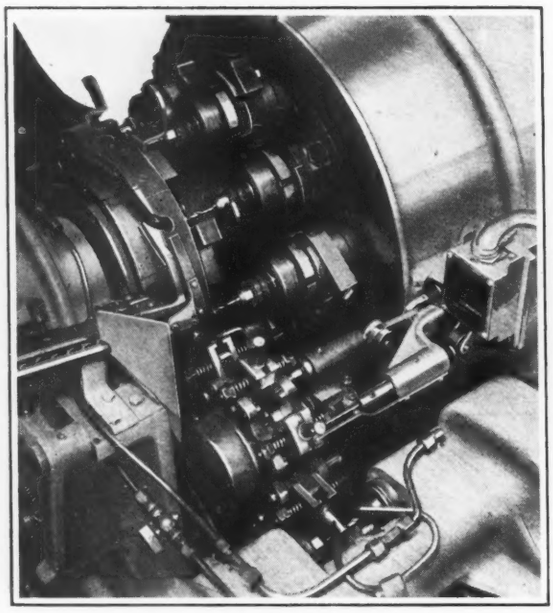
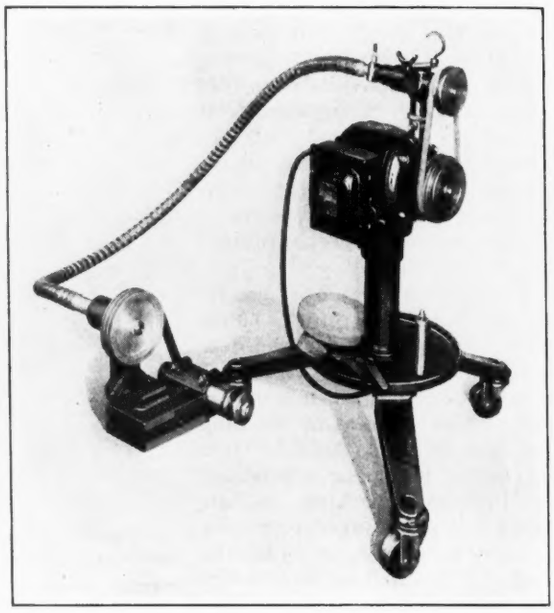


Fig. 2. View of the Fixtures, Drum, Unloading Turret, and Electrical Limit Switch



Heavy-duty Toolpost Grinder with Flexible-shaft Drive, Made by the R. G. Haskins Co.

are operated by levers at each indexing of the turret. The attachment is adjustable to suit different lengths of work.

An automatic electrical stop placed above the unloading fixture tests each drilled hole as the piece is indexed past it. This is done by means of a needle which enters the hole. If a hole is not drilled through, the needle is stopped and a limit switch operates to stop the motors. Coolant is pumped through the end of the drum shaft directly to the drills. Holes up to 1/4 inch in diameter can be drilled to a length of 5/8 inch. It is stated that clevis pins and similar parts are drilled and countersunk at the rate of 60 pieces per minute and that push-rods are handled at the rate of 145 pieces per minute.

HASKINS HEAVY-DUTY TOOLPOST GRINDER

A heavy-duty toolpost grinder designed for such work as grinding large rolls, ring dies, etc., as well as for heavy planer service, and yet small enough to fit on the average lathe without taking up too much room, has been brought out by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill. This Type HL-7 grinder can be furnished either as an external grinder, as an internal grinder, or as a combination internal and external grinder, the external and internal attachments being independent units. Wheels from 8 inches in diameter by 1 inch face width down to 2 inches in diameter can be used.

This grinder is small enough so that it can be set to grind in all positions on a lathe, with the toolpost in back of the work or in front of it. It is possible to grind at right angles to the faceplate. Because the motor is away from the grinder, difficulties resulting from motor vibration and from grit working into the commutator or motor bearings are eliminated.

The internal grinding unit is driven through three V-belts, which provide four speeds of 2250, 3050, 6750, and 9300 revolutions per minute. A 1 1/2-horsepower motor is supplied.

The external spindle is so designed that quills can be supplied for grinding holes of unusual depth. Quills from 7 to 19 inches in length are readily interchangeable. An extension spindle can also be provided for grinding holes from 2 to 3 inches in diameter; this is especially useful for shallow internal work.

GRANT RIVETING HAMMER

The No. 5A riveting hammer here illustrated has been added to the line of riveting machines made by the Grant Mfg. and Machine Co., Bridgeport, Conn. This hammer is designed to meet the needs of the automotive industry for a machine for heading cold rivets up to 5/8 inch in diameter. It is of the vibratory hammer type. The spindle, which vibrates in a vertical direction, causes the hammer to deliver between 1200 and 1500 blows per minute, the higher speed being used for the heavier jobs.

The riveting tool is threaded to fit the hammer spindle, and is made from hexagonal stock to permit the use of a wrench. The lower end of the hammer spindle bears on the flat surface at the bottom of the tapped hole in the tool. The hammer spindle is rotated clockwise through a worm drive inside the spindle arm. The helve is of seasoned hickory wood, and is held securely in a fulcrum lever. The helve

MACHINERY'S DATA SHEETS 195 and 196

PROPERTIES OF TRANSMISSION BELTING—1

W = weight of belt, in pounds per piece 1 inch wide by 1 foot long; h = thickness, in inches; T_m = maximum allowable tight side tension, in pounds per inch of width;

L = light-weight belting; M = medium-weight belting; and H = heavy belting; d_s = diameter of minimum size pulley, in inches; f = friction coefficient on cast-iron pulley.

Kind of Belt	Weight W	Tension T_m	Thickness h	Min. Diam. of Pulley d_s
Leather—Oak Tanned		$f = 0.25$		
L. Single, 14 oz.	0.073	90	1/8	3
M. Single, 16 oz.	0.083	100	5/32	4
H. Single, 18 oz.	0.094	110	3/16	5
L. Double, 26 oz.	0.136	150	1/4	7
M. Double, 29 oz.	0.151	180	5/16	10
H. Double, 33 oz.	0.172	210	3/8	16
L. Triple, 38 oz.	0.198	260	7/16	22
M. Triple, 42 oz.	0.219	280	15/32	30
H. Triple, 48 oz.	0.250	300	9/16	42
Canvas—Stitched, 28 oz.		$f = 0.20$		
3 Plies	0.072	72	0.135	8
4 Plies	0.096	96	0.180	12
5 Plies	0.120	120	0.225	16
6 Plies	0.144	144	0.270	20
7 Plies	0.168	168	0.315	26
8 Plies	0.192	192	0.360	32
10 Plies	0.240	240	0.450	40
12 Plies	0.288	288	0.540	48
Canvas—Stitched, 32 oz.		$f = 0.20$		
3 Plies	0.081	75	0.150	9
4 Plies	0.108	100	0.200	14
5 Plies	0.135	125	0.250	18
6 Plies	0.162	150	0.300	24
7 Plies	0.189	175	0.350	30
8 Plies	0.216	200	0.400	36
10 Plies	0.270	250	0.500	48
12 Plies	0.324	300	0.600	66

Kind of Belt	Weight W	Tension T_m	Thickness h	Min. Diam. of Pulley d_s
Cotton—Woven		$f = 0.22$		
L. Single	0.096	96	3/16	4
M. Single	0.110	110	7/32	6
H. Single	0.130	130	1/4	8
L. Double	0.150	145	9/32	10
M. Double	0.170	160	5/16	12
H. Double	0.190	180	11/32	16
L. Triple	0.205	200	3/8	20
M. Triple	0.225	215	13/32	24
H. Triple	0.250	230	7/16	30
Rubber, 28 oz.		$f = 0.30$		
3 Plies	0.072	72	0.150	6–9
4 Plies	0.096	96	0.200	8–12
5 Plies	0.120	120	0.250	10–15
6 Plies	0.144	144	0.300	15–18
7 Plies	0.168	168	0.350	21
8 Plies	0.192	192	0.400	24
10 Plies	0.240	240	0.500	30
12 Plies	0.288	288	0.600	36
Rubber, 32 oz.		$f = 0.30$		
3 Plies	0.081	75	0.165	10
4 Plies	0.108	100	0.220	13
5 Plies	0.135	125	0.275	16
6 Plies	0.162	150	0.330	20
7 Plies	0.189	175	0.385	24
8 Plies	0.216	200	0.440	26
10 Plies	0.270	250	0.550	32
12 Plies	0.324	300	0.660	40

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MACHINERY'S Data Sheet No. 195, New Series, February, 1931

Compiled from Data Furnished by the Dodge Mfg. Corporation

PROPERTIES OF TRANSMISSION BELTING—2

W = weight of belt, in pounds per piece 1 inch wide by 1 foot long; h = thickness, in inches; T_m = maximum allowable tight side tension, in pounds per inch of width;

L = light-weight belting; M = medium-weight belting; and H = heavy belting; d_s = diameter of minimum size pulley, in inches; f = friction coefficient on cast-iron pulley.

Kind of Belt	Weight W	Tension T_m	Thickness h	Min. Diam. of Pulley d_s
Balata, 28 oz.		$f = 0.32$		
3 Plies	0.072	72	0.150	3
4 Plies	0.096	96	0.200	5
5 Plies	0.120	120	0.250	8
6 Plies	0.144	144	0.300	12
7 Plies	0.168	168	0.350	15
8 Plies	0.192	192	0.400	18
10 Plies	0.240	240	0.500	30
Balata—Leather Strips		$f = 0.40$		
3 Plies	0.115	72	17/64	3–5
4 Plies	0.141	96	5/16	5–8
5 Plies	0.162	120	23/64	8–12
6 Plies	0.188	144	13/32	12–15
7 Plies	0.209	168	29/64	15–18
8 Plies	0.235	192	1/2	18–21
Camel Hair—Woven		$f = 0.35$		
L. Single	0.088	95	0.187	4
M. Single	0.114	120	0.242	6
H. Single	0.121	130	0.258	8
M. Double	0.161	170	0.343	12
H. Double	0.175	185	0.375	16
M. Triple	0.235	250	0.500	24
H. Triple	0.264	280	0.563	30
Leather—Mineral Tanned		$f = 0.40$		
L. Single	0.068	110	1/8	2
L. Double	0.125	180	1/4	4
L. Triple	0.188	250	3/8	8

Kind of Belt	Weight W	Tension T_m	Thickness h	Min. Diam. of Pulley d_s
Rubber, 36 oz.		$f = 0.30$		
3 Plies	0.090	78	0.180	11
4 Plies	0.120	104	0.240	14
5 Plies	0.150	130	0.300	18
6 Plies	0.180	156	0.360	20
7 Plies	0.210	182	0.420	26
8 Plies	0.240	208	0.480	28
10 Plies	0.300	260	0.600	36
Rubber Cover Only		$f = 0.32$		
1/32 Belt	0.025	...	1/32	...
1/16 Belt	0.050	...	1/16	...
3/32 Belt	0.075	...	3/32	...
1/8 Belt	0.100	...	1/8	...
3/16 Belt	0.150	...	3/16	...
1/4 Belt	0.200	...	1/4	...
Rubber Fabric		$f = 0.35$		
5 Plies	0.051	50	3/32	.....
7 Plies, L. Single	0.067	65	1/8	2–3
9 Plies, M. Single	0.084	80	5/32	4–5
11 Plies, H. Single	0.100	95	3/16	6–8
14 Plies, L. Double	0.124	120	1/4	9–12
17 Plies, M. Double	0.148	150	5/16	16–18
21 Plies, H. Double	0.181	190	3/8	20–22
Leather—Oak Tanned and Mineral Tanned		$f = 0.25$ or 0.40		
H. Single	0.093	130	3/16	4
H. Double	0.167	230	3/8	10

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MACHINERY'S Data Sheet No. 196, New Series, February, 1931

Compiled from Data Furnished by the Dodge Mfg. Corporation

and hammer spindle are driven through this lever by an eccentric bearing in the center of the main drive shaft which transmits the required reciprocating motion through rubber cushions.

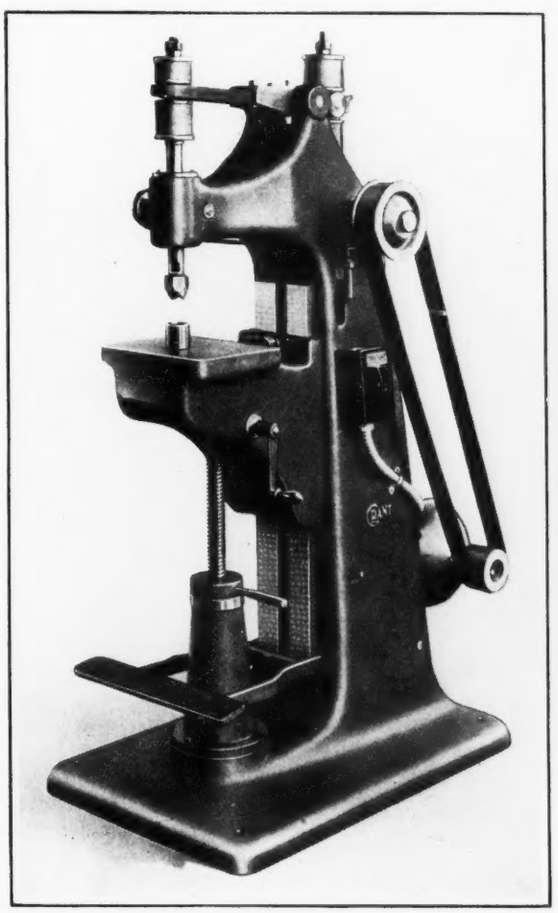
An extra heavy table is provided to insure rigid support for the work and to reduce the tendency of the work to jump off the anvil when struck by the hammer. The table is supported by a jack-screw and is clamped to the frame by two heavy bolts. The jack-screw is also used to raise and lower the table, a crank at the side of the machine serving to turn the jack-screw through the rotation of a pair of miter gears. A simple forward movement of a conveniently located lever serves to lock the jack-screw in position when riveting. Both the table and the jack-screw can be easily removed to allow special tables and fixtures to be substituted. A brake operated by a foot-treadle is provided for stopping the hammer spindle in its uppermost position to facilitate the insertion or removal of the work. A three-horsepower motor having a speed of 750 revolutions per minute is required for driving the machine. With this equipment, an iron rivet 5/8 inch in diameter can be headed in two seconds.

FEDERAL DIAL-FEED MECHANISM

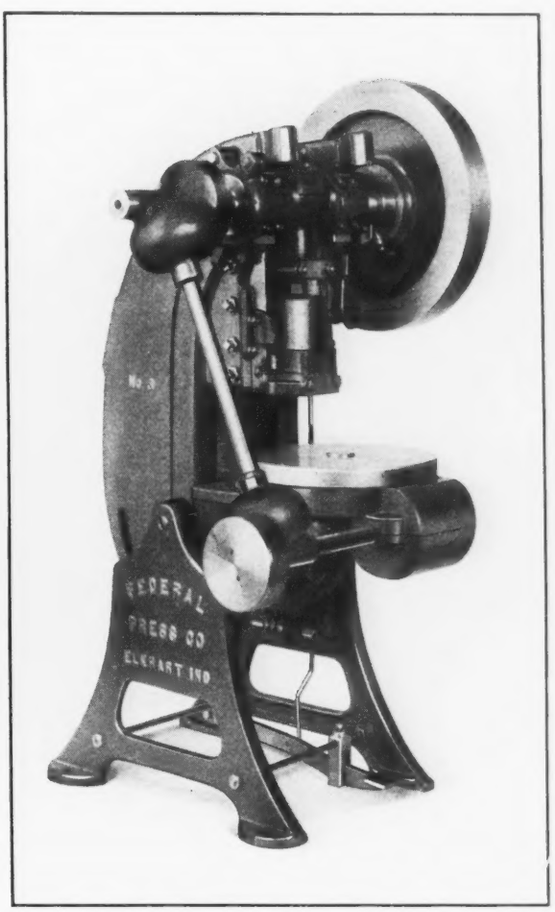
A dial-feed mechanism for which a new principle of indexing is claimed has been designed by the Federal Press Co., Elkhart, Ind., for application to punch presses of any make and other equipment. In the illustration the dial feed is shown applied to a punch press. The dial is actuated by the crankshaft through two sets of bevel gears and a cam under the dial plate. This cam engages hardened rollers attached to the bottom side of the dial. At every revolution, the crankshaft rotates the dial one-twelfth of a turn. The same cam that actuates the dial locks it positively in place by passing between rollers on the bottom of the dial.

One of the advantages claimed for the new mechanism is that it prevents skidding without the use of brakes, stops, or lock pawls. The only moving part exposed is the dial plate. The cam that actuates the dial runs in a bath of oil.

Another important feature is that the dial movement is accomplished in less than a quarter revolution of the crankshaft. In fact, almost the entire indexing



Grant Riveting Hammer with Capacity for Cold Rivets up to 5/8 Inch in Diameter



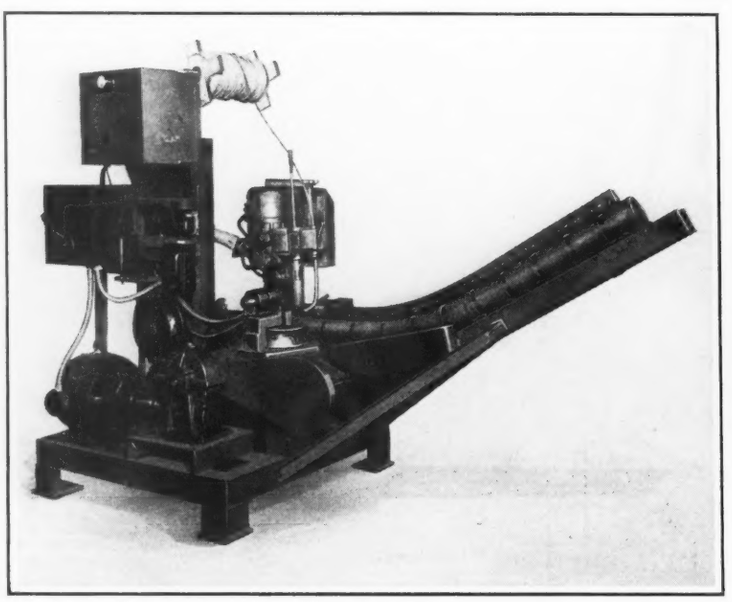
New Type of Dial-feed Mechanism Applied to a Federal Punch Press

takes place while the crankpin is passing through the top quarter of the stroke and while the ram is almost at a standstill. This is an especially important consideration when the job requires considerable die space. A kick-out mechanism for ejecting the work pieces from the dial plate is actuated from the camshaft beneath the dial.

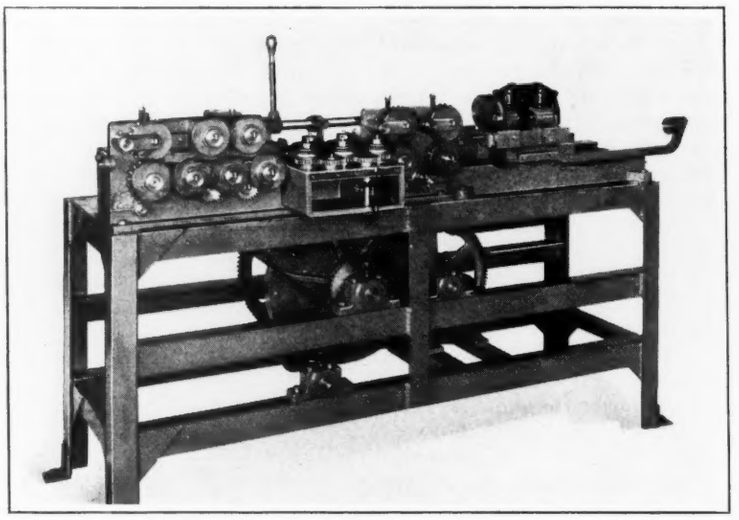
AUTOMATIC WELDER FOR AUTOMOBILE STARTER FRAMES

An automatic welder designed for the welding of automobile starter frames has been announced by the Lincoln Electric Co., Cleveland, Ohio. The principles of the shielded arc and the electronic tornado process are embodied in the design of this machine. The starter and generator frames welded on this machine are usually of 5/16 or 3/8 inch plate, which is cut to size and shape and punched and rolled into cylinders before being arc-welded. The rolled cylinders are fed into the gravity conveyor shown in the illustration. This conveyor is designed to keep the seams of the pieces uppermost.

At the bottom of the gravity conveyor the work passes between two rolls which squeeze the seam together tightly as it passes under the arc. No filler rod is used, as the two edges of the seam are fused together. The machine has a capacity for welding approximately 240 frames per hour, and one man and a helper can operate four machines simultaneously. Under average operating conditions, the cost of welding the frames is approximately one-half cent each.



Lincoln Automatic Welding Machine Designed for Welding Automobile Starter Frames



Artos Automatic Machine for Straightening, Measuring, and Cutting off Copper Tubing

AUTOMATIC STRAIGHTENING AND CUTTING-OFF MACHINE

In the manufacture of such products as refrigerators, unit heaters, and radiators, copper tubing must be straightened and cut to predetermined lengths. The need for equipment that would speed up this operation of straightening, measuring, and cutting led to the development, by the Artos Engineering Co., 119 Brown St., Milwaukee, Wis., of the automatic machine here illustrated.

After the end of a coil of tubing has been inserted in the feeding rolls of this machine, the feeding, straightening, measuring, and cutting of the tubing is automatic. The feed is at the rate of about fifty feet per minute, but the actual production depends upon the length of the pieces to be cut. For example, with 12-inch lengths, the production is approximately 22 pieces per minute, and with 24-inch lengths, about 15 pieces are produced per minute.

The machine is adjustable for any cut up to 6 feet in length, and it can be built for lengths within commercial requirements. An attachment can be furnished for trimming off the end of a coil of tubing before the first piece is cut to length. The machine is

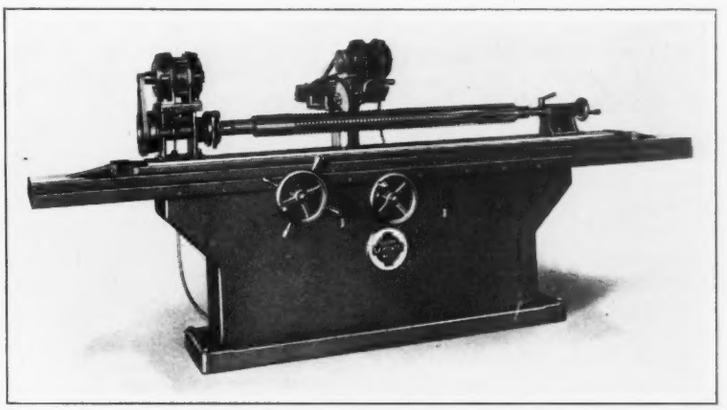
furnished with a main driving motor and an independently motor-driven circular saw. In addition to the uses mentioned, it is also adapted for handling copper tubing such as is used for feed-pipes in automobiles.

LAPOINTE BROACH-SHARPENER

The provision of ball bearings for the table and swivel-head slide of a broach-sharpening machine recently developed by the Lapointe Machine Tool Co., Hudson, Mass., results in an exceptionally easy moving table and slide. This feature is most noticeable, of course, when a heavy broach is being sharpened. The ball bearings are mounted between hardened steel ways.

The grinding spindle is also mounted in ball bearings in the swivel-head. The latter can be turned to any position for obtaining the desired cutting angle on broach teeth. The swivel-head slide can be turned in a horizontal plane to permit sharpening the teeth of rectangular broaches at any angle.

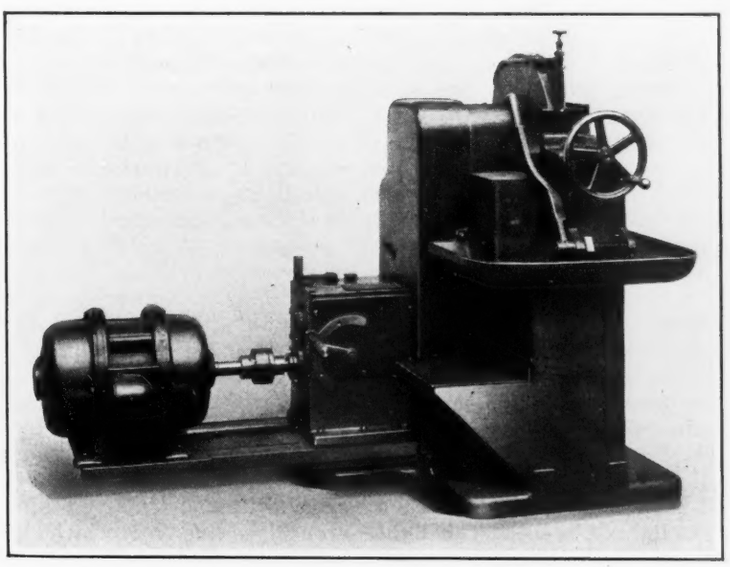
One of the handwheels with which the machine is provided is used to move the table, and the other to elevate the grinding head assembly to the proper position for sharpening the broach.



Lapointe Broach-sharpener Equipped with Ball Bearings to Provide an Easy-moving Table and Swivel-head Slide

In the sharpening operation, the swivel-head slide is moved back and forth across the cutting edge of the broach teeth by means of a handle attached to the slide.

Round broaches can be sharpened by using a lathe dog on the headstock to revolve the broach in contact with the grinding wheel. For such operations, the grinding wheel is positioned directly over the center of the broach after the swivel-head has been adjusted to the proper cutting angle. When rectangular or polygon broaches are being sharpened, the work is held stationary and indexed by the use of an index-plate on the headstock. Broaches up to a maximum length of 60 inches can be handled between centers. A 3/4-horsepower motor drives the grinding-wheel spindle, and a 1/2-horsepower motor the headstock.



Cochrane-Bly Machine for Cutting off Work with an Abrasive Wheel, Saw, or Friction Disk

COCHRANE-BLY CUT-OFF MACHINE

The No. 21 abrasive cut-off machine here illustrated has been developed recently by the Cochrane-Bly Co., St. James St., Rochester, N. Y. It has been designed with the object of obtaining high wheel efficiency, increased rate of cutting, and a maximum number of cuts for a given amount of wheel wear. With this machine, round cold-rolled bar stock 1 7/16 inches in diameter has been cut off in 2 1/2 seconds. A saw can be used in place of the 16-inch abrasive wheel, when desired, for cutting non-ferrous metals, wood, fiber, Bakelite, light steel sections, etc.

The spindle is hardened and ground and is mounted in dust-proof Timken roller bearings. The heavy carriage is mounted on ball bearings, which permit it to be operated with ease by means of a hand-lever. This arrangement is designed to give the smooth movement required in making accurate cuts. The carriage is extended at the front to cover the ball bearing ways fully and protect them from grit.

The drive is through a four-

speed gear-box having hardened nickel-steel gears which run in oil and shafts mounted in Timken roller bearings. The four spindle speeds range from 2400 to 3600 revolutions per minute, giving the 16-inch abrasive wheel four surface speeds from 10,000 to 15,000 feet per minute. These speeds can be changed to compensate for the reduction in the wheel diameter as wear occurs.

The drive from the speed-box to the spindle is by multiple V-belts. An idler pulley maintains a uniform belt tension and compensates for the change in the distance between the pulleys caused by the carriage movements. The machine is designed for either wet or dry cutting. A pump is provided which delivers a stream of coolant or lubricant to the abrasive wheel or saw. The wear on the wheel is claimed to be one-half as great when a coolant is used as when cutting dry.

The machine has a capacity for cutting off round stock up to 4 inches in diameter. Spindle speeds from 4200 to 6000 revolutions per minute can be used for cutting with a friction disk. A floor space of 38 by 40 inches is required for the belt-driven type, and a space of 38 by 68 inches for the motor-driven machine. A motor delivering from 5 to 15 horsepower may be used. The net weight of the machine with the belt drive is about 1500 pounds.

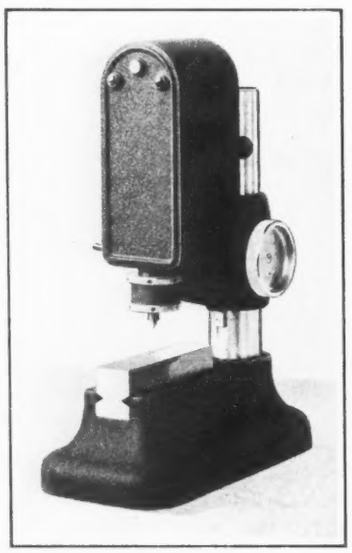


Fig. 1. Sheffield Electric Gage which Shows Inaccuracies up to 0.00001 Inch

SHEFFIELD ELECTRIC GAGE

Accuracy to one hundred-thousandth of an inch is claimed for an electric gage being introduced on the market by the Sheffield Machine & Tool Co., Dayton, Ohio. Other advantages cited are that the gage does not depend upon human judgment or the sense of touch, that it is of rugged construction in spite of its sensitivity, and that there are no wearing parts, with the exception of the anvils. Fast gaging of parts is possible, because the operator does not hesitate in making readings, since the signals flash instantly. The gage can be set to maximum tolerances, thus reducing the amount of rejected work and at the same time insuring that incorrect parts will not be passed.

From Fig. 2 it will be seen that an indicating lever travels between two contact points. These points can be adjusted to any required tolerance from 0.00002 to 0.002 inch. Motion is transmitted to the indicating lever by parallel spring-steel reeds, to which it is attached. These reeds, in turn, are fastened to two blocks, of which the right-hand block is secured to the frame, while the left-hand block is merely tied to the rigid block by two other spring-steel reeds.

The movable block is held down against the plunger of the upper anvil by a coil spring. When work is placed under this anvil, the movable block is forced upward, so that it distorts the reeds that support the indicating lever and causes the lever to move from side to side. Normally, the coil spring holds the movable block down, so that the indicating lever rests against the left-hand contact and causes a green light to be seen. This light will continue to burn if undersized work is placed under the anvil, but when the work is correct, the lever moves into the vertical position, the green light goes out, and an amber light flashes on. Should the work be over size, the lever proceeds farther to the right and a red light is seen.

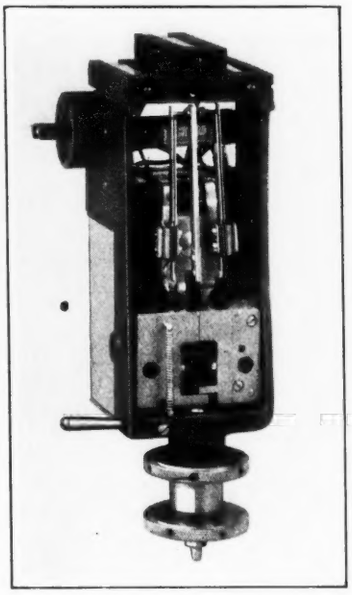


Fig. 2. Construction of the Electric-gage Indicating Unit

"NO-INK" DRAWING-BOARD TOP

The "No-Ink" drawing-board top recently placed on the market by the W. H. Long Co., 420 N. Clark St., Chicago, Ill., consists of a white composition having a smooth drawing surface that is tough, resilient, stain-proof, and can be washed with soap and water. This material is obtainable in any size sheets, 1/8 inch in thickness, and can be glued or fastened to old drawing boards. The regular drawing or tracing paper is placed directly on the surface of this board.

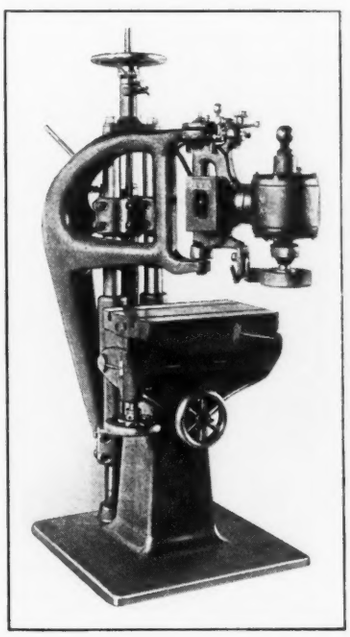
A 3-H or harder pencil may be used, and all lines should be drawn with a double stroke and a light pressure. The first stroke will ridge or groove the paper, while the back stroke will fill the groove with lead. This results in an even edged line from which clear blueprints can be made. Changes in the drawings can be made by erasing the lines in the usual

manner, as the ridges or valleys will not show on the blueprints. The indentations or grooves disappear immediately from the surface of the board on account of the resiliency of the material.

"ACE" SURFACE GRINDER

The "Ace" surface grinder, developed and built by R. P. Thompson, Pocomoke, Md., is being placed on the market by L. V. Goebbels, 4419 Larchwood Ave., Philadelphia, Pa. The operation of this machine is unique in that the grinding wheel is usually passed over the work instead of having the work travel past the wheel. It is claimed that this feature enables the operator more readily to determine or "feel" the highest rate of feed at which the wheel is able to cut efficiently. The work-table is adjustable at an angle to the plane in which the wheel travels, both in the transverse and lateral directions. Work of irregular shape may be placed on the table, and the table can then be adjusted until the surface to be ground is in the proper plane.

This grinder is especially adapted for the maintenance of punches and dies, as the scales and indicators permit the table to be reset for duplicating the amount of shear ground on the cutting or punching members. Attachments of various kinds are available for use in grinding cutters, reamers, knives, etc. The grinding table is 12 by 18 inches. The grinding wheel can be swung around so that it is entirely clear of the grinding table, and can be used to surface-grind large work placed on the floor at the end of the grinding table. The height of the travel of the wheel over the table is 11 inches. A 5-inch wheel is used with a 3/4-horsepower motor having a speed of 3400 revolutions per minute.



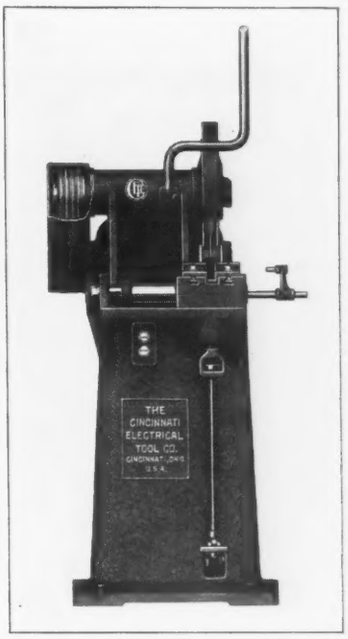
"Ace" Swinging-arm Type Surface Grinder

HIGH-SPEED ABRASIVE CUT-OFF MACHINE

A high-speed cut-off machine intended for cutting steel alloys; non-ferrous metals, such as brass, copper, and aluminum; and fibrous materials has recently been brought out by the Cincinnati Electrical Tool Co., Division of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine will handle various sizes and shapes of work up to 2 1/4 inches, inclusive. It uses an abrasive wheel, either 12 or 14 inches in diameter by 3/32 inch in thickness, which is operated at a peripheral speed of 15,000 to 16,000 feet per minute.

The wheel is guarded completely, with the exception of the part required for the cutting operation. Sparks and abrasive dust are carried off through an exhaust connection with a water pan inside the pedestal. The cutting-wheel spindle, wheel, and wheel guard are mounted on a swivel arm which pivots on the pedestal and is balanced by the weight of the motor at the rear. The motor is mounted on the same arm, is of 7 1/2 horsepower capacity, and runs at 3600 revolutions per minute. It drives the wheel-spindle through V-belts.

Cuts can be taken straight or at angles up to 45 degrees. The material to be cut is held in the vise by applying pressure to the foot-lever, while the abrasive wheel is moved in to the work by means of the hand-lever at the front of the machine. Water or other coolant is not required. A stop can be set to govern the depth of cut and the length of the material to be cut is regulated by means of a longitudinal stop. The weight of this machine is about 1250 pounds.

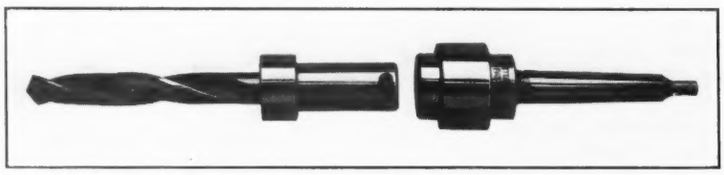


High-speed Cut-off Machine Built by the Cincinnati Electrical Tool Co.

TITAN "TWIST DRIVE" COLLET

A new collet is being placed on the market for use with the quick-change chucks made by the Titan Tool Co., Erie, Pa. This "Twist Drive" collet, as it is called, will drive straight-shank drills from the smallest to the largest sizes. A separate collet is used for each drill size.

On the outside these collets are the same as all other Titan collets. The driving means consist of two hardened steel balls which are inserted from the exterior and project inward into the central hole a sufficient distance to come into contact with the flutes of the drill in such a manner as to drive the drill without damaging it. Thus the collet can be used for driving broken straight-shank drills. The balls



Titan "Twist Drive" Collet with Quick-change Chuck and Drill

are held permanently in place by a collar shrunk on the collet.

With the "Twist Drive" collet, the drills can be located at unusually close center-to-center distances. It is as adaptable to turret lathes and portable tools as it is to drilling machines. Seven of the collets and one Titan quick-change chuck cover the ordinary range of requirements in the garage field.

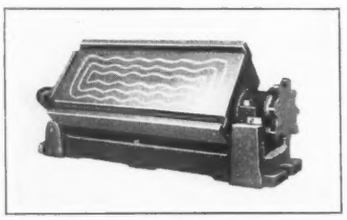


Fig. 1. J. & H. Magnetic Chuck Tilted for Grinding Bevels

SWIVEL-TAPER MAGNETIC CHUCK

A combination swivel-taper magnetic chuck has been brought out by the J. & H. Electric Co., Inc., 200 Richmond St., Providence, R. I., for grinding bevels and tapers on parts, as well as for general tool-room work. This chuck is now available in sizes of 5 by 13 inches and 7 by 16 inches. The essential parts consist of a base, a cradle, and a trunnioned magnetic chuck.

The base is clamped to the machine on which the chuck is to be used. It carries the cradle, elevating screws, indicator plates, and pointers for taper grinding. The cradle is pivoted at one end and is provided with capped bearings to suit the turned trunnions on the chuck.

For grinding bevels, the cradle is locked in the zero position and the chuck is swiveled to the desired angle, as determined by means of a ring having 2-degree graduations. The maximum bevel for which the chuck can be set is 45 degrees from the horizontal in either direction. Fig. 1 shows the device set up for grinding bevels.

For grinding tapers, the chuck is locked in the zero position and the cradle is raised by means of elevating screws until the indicator registers the desired amount of taper. This indicator is graduated in steps corresponding with 1/8 inch per foot to a maximum of 1 inch per foot. In Fig. 2, the chuck is shown set up for grinding tapers.

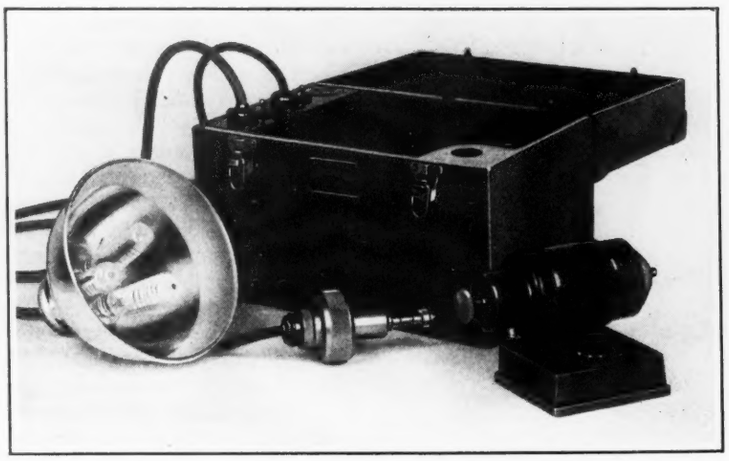
IMPROVED MODEL VIBROSCOPE

The Model 3 Vibroscope shown in the accompanying illustration has been developed by the Electrocon Corporation, 6 Varick St., New York City, to meet the demand for an instrument of greater illuminating power than the Model 1 Vibroscope, which has been on the market for the last six years. In the new model, the illumination has been increased to about five times that available with the previous model. The motor unit is also a new feature.

This portable equipment provides a means of observing the behavior of rapidly moving machine parts conveniently, and is applicable to the study of rotary, reciprocating, or any type of cyclic motion at any speed. The moving parts can be made to appear perfectly stationary at any desired position in the cycle of operations by the light from the powerful neon lamp which flashes in synchronism with the motion.

The flashing lamp is controlled either by the breaker head, driven directly from the mechanism under observation, or by the properly governed motor unit which is not connected with the other equipment. By adjusting a knob on the breaker head or by throwing the motor unit slightly out of synchronism with the moving parts, the movements can be observed at greatly reduced speed, as in a slow motion picture. The equipment, complete with battery, weighs only 24 pounds.

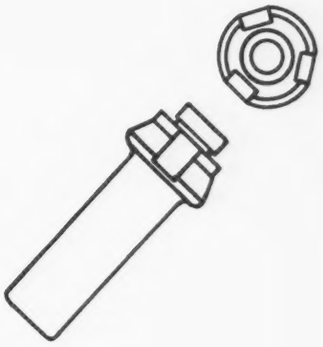
Fig. 2. Setting of the J. & H. Chuck for Grinding Tapers



Improved Vibroscope Brought out by the Electrocon Corporation

Two Seconds A Slot—

On a Brown & Sharpe No. OY

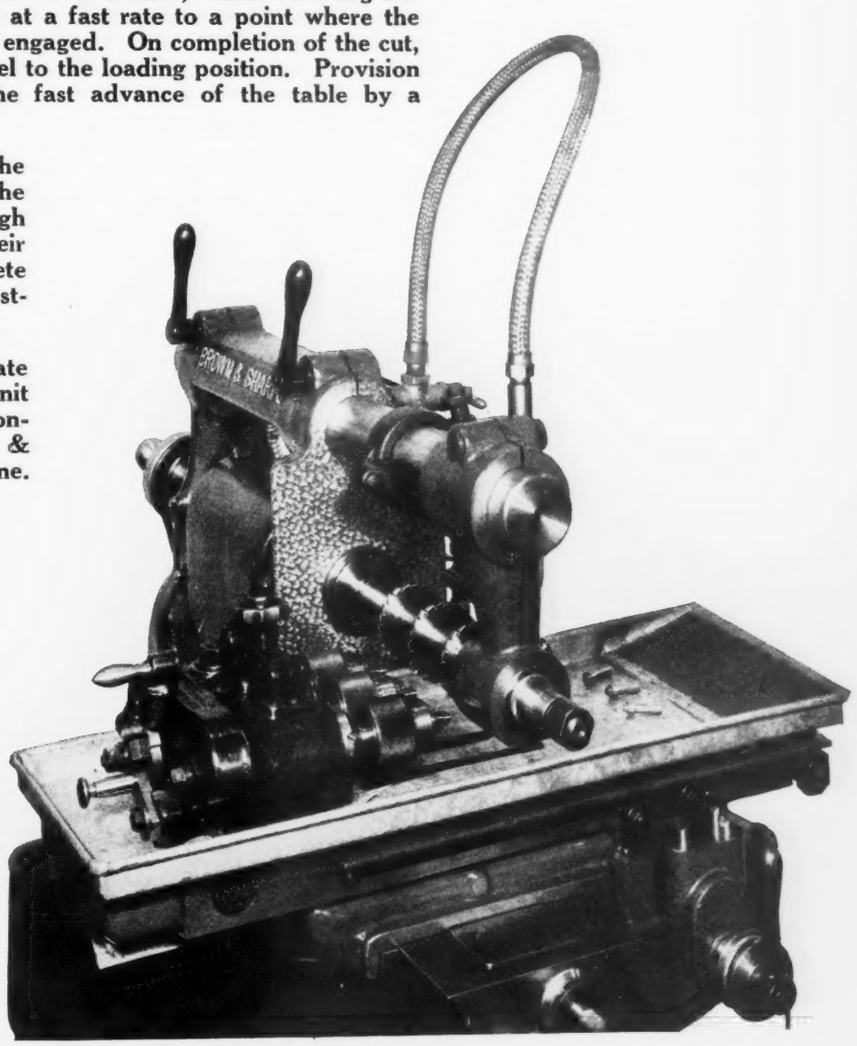


234 friction sleeves, three slots in each sleeve, are produced hourly by this Brown & Sharpe No. OY Plain Milling Machine. Triple Index Centers are used to hold the work, which are indexed upon completion of each slot, bringing the sleeves into position for the next cut.

The ability of this machine to establish and maintain high production rates on small work of this type is due to the unusual convenience of control and the semi-automatic table operation. The No. OY is equipped with a foot-treadle, which on being depressed, advances the table at a fast rate to a point where the cutting feed is automatically engaged. On completion of the cut, the table returns at fast travel to the loading position. Provision is also made to engage the fast advance of the table by a hand lever.

Many shops are handicapped by the equipment they are now using. The economies that can be effected through the use of modern machines make their purchase, for replacement of obsolete equipment, a highly profitable investment.

When your milling requirements dictate the selection of a rapid production unit for milling small parts, it is well to consider the performance of a Brown & Sharpe No. OY Plain Milling Machine.

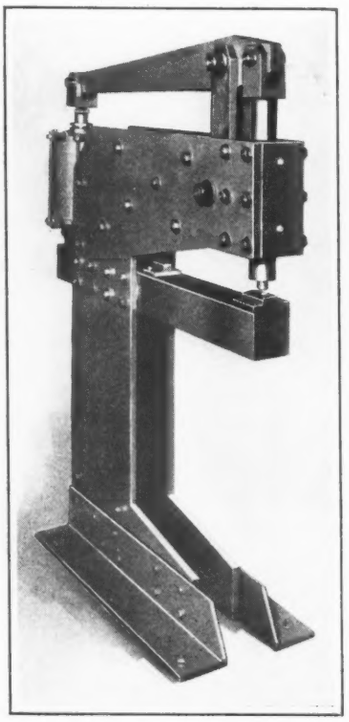


Capacity:

Longitudinal Feed, 13″ Automatic
Transverse Feed, 6″
Vertical Feed, 15″

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.



Air-operated Punching Machine

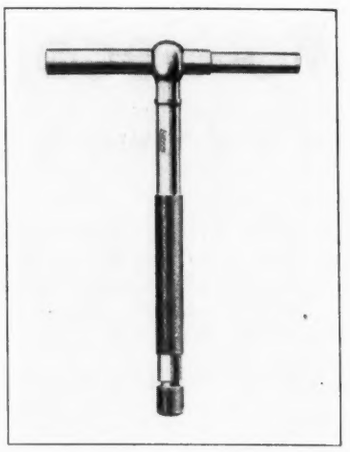
HANNIFIN AIR-OPERATED PIERCING PRESS

A machine designed for punching 1 5/16-inch holes in cylindrical boiler shells made of 3/16-inch copper was recently built by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., for the Dahlquist Mfg. Co., South Boston, Mass. This machine uses compressed air as a source of power. With the exception of the air cylinder, it is constructed entirely of standard steel plates and shapes. The equipment has been tested to exert a force of 24,000 pounds. Other specifications are as follows: Ram stroke, 1 1/8 inches; reach, 25 inches; cylinder bore, 8 inches; and cylinder stroke, 8 inches.

LUFKIN TELESCOPING GAGE

In the telescoping gage recently placed on the market by the Lufkin Rule Co., Saginaw, Mich., the handle is always in the center. An advantage claimed for this design is that a balance and feel are obtained which are desirable in accurate measuring.

In taking a measurement, the user compresses the plungers, locks them, inserts the gage into the hole or slot to be measured, releases the lock so that the plungers can expand to the size of the hole, locks the plungers again, removes the gage, and measures the distance across the plungers with a micrometer. The gage is made in five sizes for holes from 1/2 to 6 inches.



Telescoping Gage with Handle that is Always in the Center

"BULLDOG" MAGNETIC BLOCKS

A standardized, interchangeable, magnetic block known as the "Bulldog" has recently been placed on the market by the Congress Tool & Die Works, 430 S. Green St., Chicago, Ill. These blocks are built up of a number of laminations of special alloy electric steel, separated by non-magnetic layers or segments of uniform thickness, as shown in Fig. 1. All sections are riveted together by non-magnetic rivets. The blocks measure 3 3/4 by 2 1/2 by 1 1/4 inches. All faces are ground true and all opposite surfaces are parallel.

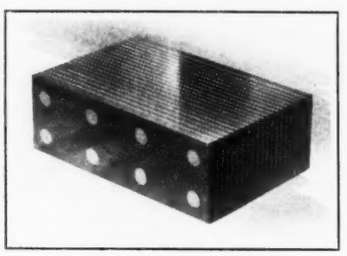


Fig. 1. "Bulldog" Magnetic Block

A desirable feature of these blocks is that they have good holding power when placed close to the edge of a standard electric chuck or table. Fluctuations in the voltage applied to the chuck as a result of starting large motors, etc., do not affect the holding power. The interchangeable feature permits two or more blocks to be used together without the necessity of making troublesome set-ups or measurements. Sheet steel 0.005 inch thick can be held by one of these blocks, so that 0.0001 or 0.0002 inch can be ground off without difficulty. The blocks can also be used to advantage in grinding punches or other pieces of irregular shape. The pieces to be ground may be placed on the top of the block or held against the side.

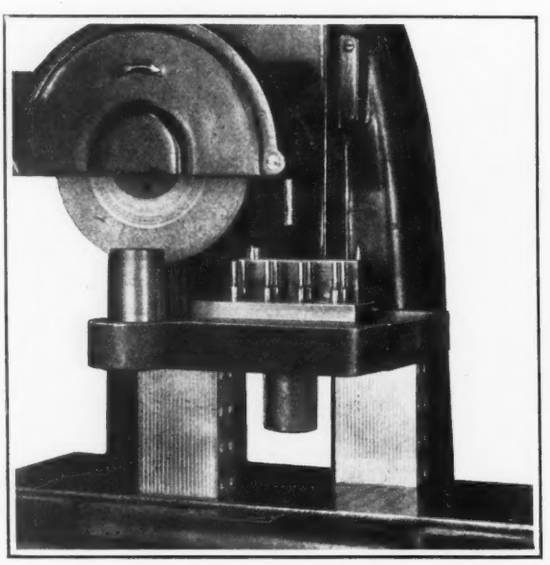


Fig. 2. Typical Set-up, Using "Bulldog" Magnetic Blocks

Write for
Bulletin 4081

Permanent Precision—

1. Square locked narrow guides.
2. Forged Steel Taper Gibs.
3. Feeding screws placed in center of narrow guides.
4. Guides and screws placed as close to cutting tool as is mechanically possible.
5. No keyways cut in feeding screws to destroy their accuracy.
6. Feeding nuts can always be centralized with feeding screws when adjustments are made.
7. Feeding screw and guide for table saddle placed in center of bed.
8. Ball bearings used liberally on all hand adjustments to eliminate friction, thereby permitting accurate setting of all units.

Not only is this paramount quality *built into* Ohio Horizontals, but provision is made for retaining it to the finest degree throughout the life of the machine.

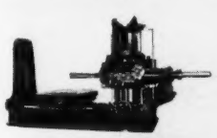
Eight of the features that assure permanent accuracy in Ohio Horizontal Boring, Drilling and Milling Machines are listed at the left. How these features affect the production of fine work and also other exclusive features of these machines are explained, in a semi-technical manner easily understood, in our new Bulletin 4081. Let us send you a copy.

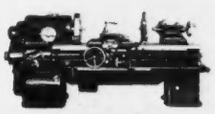
Ohio Horizontal Boring, Drilling and Milling Machines are built in all standard types and sizes:—the table type—planer table type—floor type—and combination floor and table type machines; meeting all requirements for high grade machine tools of this kind.

THE OHIO MACHINE TOOL CO.
KENTON, OHIO

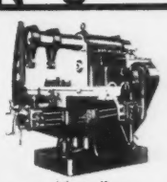
JOSEPH T. RYERSON & SON, INC.
Chicago and Principal Cities
FINE MACHINE TOOLS
STRUCTURAL—PLATE—SHEET METAL
SHOP EQUIPMENT
RAILROAD MACHINERY
WELDERS—SMALL TOOLS

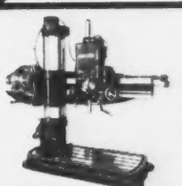
RYERSON MACHINERY DIVISION of GENERAL DISTRIBUTORS


Ohio Horizontal Boring, Drilling and Milling Machines


Monotrol and Tritrol Lathes

Ohio Shapers and Planers


Maximillers
Formerly built by Kempsmith


Dreses Radials

SOLD THROUGH EXCLUSIVE LOCAL DEALERS

PERSONALS

ROLAND N. JESSOP has been appointed assistant sales manager of the Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio.

C. R. MESSINGER, president of the Chain Belt Co., Milwaukee, Wis., has been elected to the presidency of the Oliver Farm Equipment Co., a corporation formed last year through the

C. R. Messinger

merger of the Oliver Chilled Plow Works with a number of other companies in the agricultural equipment field, including the Hart-Parr Co., well-known pioneer in the gasoline tractor field.

C. B. MURPHY has been appointed manager of the stationary Diesel engine sales of Fairbanks, Morse & Co., with headquarters at 900 S. Wabash Ave., Chicago, Ill.

G. K. VIALL, who has been connected with the Chain Belt Co., Milwaukee, Wis., since 1921, and who has been works manager since 1929, has been elected a vice-president of the company.

HERBERT M. ORSCHEL has been appointed field sales manager of the Aeroil Burner Co., Inc., Park Ave. at 13th St., West New York, N. J., manufacturer of industrial oil burning equipment.

C. H. KEENEY has been appointed sales manager of the Northern Blower Co., Cleveland, Ohio, manufacturer of exhaust fans, suction filters, sand-blast rooms, exhaust systems, and kindred products.

HERBERT A. MAY has been appointed assistant to the president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. May will make his headquarters in the Grant Bldg., Pittsburgh, where the offices of the Westinghouse central sales district are located.

MALCOLM CARRINGTON, formerly director of finished stocks of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been made assistant to the vice-president. In his new capacity, he will have general supervision of shipping stocks, order procedure, and office operations.

HARRY W. KING, formerly head of the engineering department of the Morgan Engineering Co., has joined the Aetna-Standard Engineering Co., Youngstown, Ohio, as assistant vice-president. Mr. King served, for many years, as assistant to C. L. Taylor, formerly vice-president of the Morgan Engineering Co., and is now rejoining Mr. Taylor at the Aetna-Standard Engineering Co., in the same capacity.

A. E. SHEPARD has been made general manager of the C. F. Laganke Co., Inc., 118 St. Clair Ave., N.E., Cleveland, Ohio, manufacturer of special tools, dies, and gages. Mr. Shepard was formerly factory manager of the Sommer & Adams Co., and for thirteen years was master mechanic of the B. F. Goodrich Co. of Akron, Ohio. H. E. HENRY, formerly of Tools & Gages, Inc., has been placed in charge of sales.

R. R. WASON has been elected president of Manning, Maxwell & Moore, Inc., succeeding C. A. MOORE, who has been president of the company since April, 1927. Mr. Moore will continue to serve as chairman of the Board of Directors. Mr. Wason also was elected president of the Consolidated Ashcroft Hancock Co., Inc., one of the large subsidiaries of Manning, Maxwell & Moore, Inc. He will make his headquarters at the main office of the company at 100 E. 42nd St., New York City.

L. W. GREVE, active head of the Cleveland Pneumatic Tool Co., Champion Machine & Forging Co., and the Cleveland Rock Drill Co., has been made president of the National Air Races, Inc., a non-profit making organization which has been arranged to underwrite and sponsor the annual National Airplane Races in Cleveland for the next ten years. Mr. Greve is a past-president of the American Drop Forging Institute, and was chairman of the Pneumatic Tool Committee of the War Industries Board during the World War.

F. W. PEEK, JR., has been appointed chief engineer of the Pittsfield, Mass., Works of the General Electric Co., Schenectady, N. Y., succeeding Guiseppe Faccioli, who retired a few months ago because of ill health. Mr. Peek became connected with the company upon graduating from Leland Stanford University in 1905, and he has been engaged in general consulting work on practical and theoretical engineering problems and research work. He will be succeeded by FREDERICK F. BRAND as managing engineer of the power transformer department.

R. R. WEDDELL, formerly chief engineer of the O. K. Tool Co., Inc., Shelton, Conn., has been appointed sales manager and will be succeeded by E. REANEY as chief engineer. A. CURRY has been appointed production manager, succeeding OLE SEVERSON, who is now in charge of all the development and research work of the company. H. GILLER, formerly chief tool supervisor of the Chrysler Motor Car Co., is now representing the O. K. Tool Co. in the Detroit territory. Mr. Giller's headquarters are at 5235 Buckingham Ave., Detroit. He succeeds J. COSTELLO, who has been appointed assistant sales manager for the machine tool branch of the trade.

CLIFFORD F. MESSINGER, formerly vice-president and general manager of the Chain Belt Co., Milwaukee, Wis., has been elected president of the company, succeeding his brother, C. R. MESSINGER, who has resigned to become president of the Oliver Farm Equipment Co., and who has also been elected chairman of the board of the Chain Belt Co. C. F. Messinger has been with the Chain Belt Co. since 1911, when he graduated from the Sheffield Scientific School of Yale University. He first served a two-year student apprentice course and then became successively advertising manager, sales manager, vice-president and general manager, which latter position he will still continue to hold.

RALPH W. BURK, who for the last three years has been manager of the Detroit sales office of the Kearney & Trecker Corporation, Milwaukee, Wis., has been promoted to the position of

Ralph W. Burk

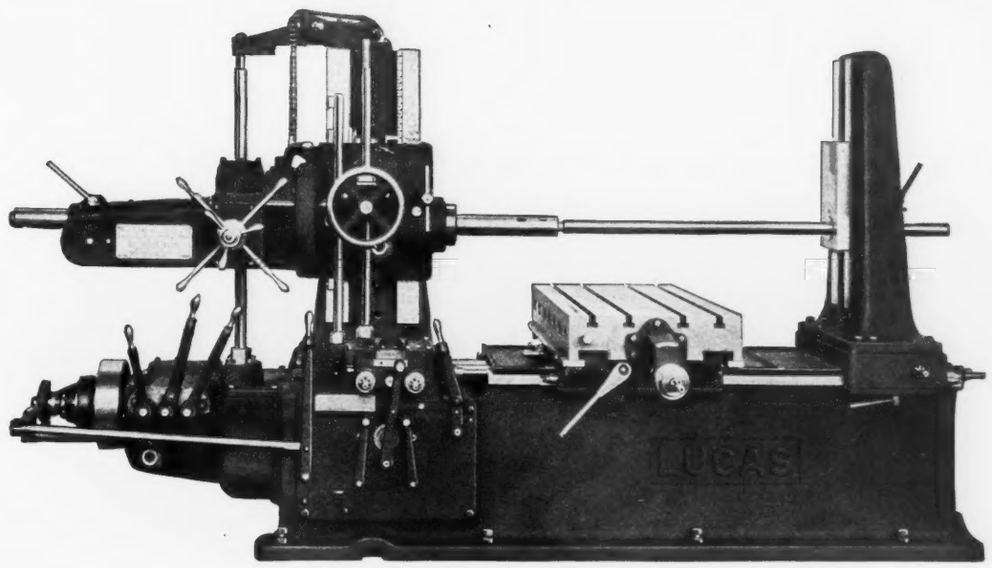
sales manager of the eastern division, with headquarters in Philadelphia, and will have supervision over the sale of Milwaukee milling machines in five eastern territories. Mr. Burk will be succeeded in Detroit by F. G. JACKSON, formerly district manager of the Philadelphia territory.

THOMAS S. PERKINS, formerly manager of supply engineering and consulting engineer with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been made general manager of distribution engineering.

IN [POOR / GOOD] TIMES *prepare for* [GOOD / POOR] TIMES

AT ALL TIMES *you need a*

Modern LUCAS "Precision" Horizontal Boring, Drilling and Milling Machine



When work is scarce, in order to get your share you must be equipped to handle it economically, quickly and accurately, performing the several different operations in correct relation at a single setting.

When you are rushed with business, you want a machine which is reliable in every way, designed and made so as to stand up in continuous service.

Get your LUCAS now while the getting is good!

THE LUCAS MACHINE TOOL CO.

CLEVELAND, OHIO

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy. Catmur Machine Tool Corp., Ltd., London.

OBITUARIES

W. FLETCHER BARNES

William Fletcher Barnes, founder of the W. F. and John Barnes Co., Rockford, Ill., died at his home in Rockford December 28, at the age of eighty-nine. Mr. Barnes was born on a farm near Mount Morris, N. Y., in 1841. He went to Rockford in 1861, and after working there for three years, went to Aurora, Ill., to work in the shops of the Chicago, Burlington & Quincy Railroad. In 1868 he returned to Rockford, working in the Clark & Utter factory. At that time he had a small shop in his home, where he worked out some of his first inventions, making models in his spare time. He later opened a model shop in which his brother Frank worked with him, and at that time the jig saw, an invention with which Mr. Barnes' name is linked, was developed.

When the popularity of the jig saw became apparent, Mr. Barnes and his brother John formed the W. F. and John Barnes Co. and began to manufacture the machine in 1873. The factory also made saws and grinders of several kinds, and shortly afterward the company began to manufacture an upright drill of Mr. Barnes' design. In 1882, a factory was built on the site still occupied by the company. Here Mr. Barnes specialized in making drilling machines, with which line of machinery the name of the company has ever since been identified. A number of years ago, Mr. Barnes retired from active business. He is survived by his son W. F. Barnes, Jr., and a daughter, Mrs. Amy Barnes Lane.

W. Fletcher Barnes

JAMES MORPETH, for many years general superintendent of the Brown & Sharpe Mfg. Co., Providence, R. I., died January 15 at Tangerine, Fla., where he had been staying on account of ill health. Mr. Morpeth was sixty-seven years old. He was born in Carlisle, England, and came to Pawtucket with his parents at an early age. As a boy, he worked in Pawtucket for a few years, and then became connected with the Brown & Sharpe Mfg. Co. as a machinist apprentice. After he finished his apprenticeship, he continued with the company, assuming continuously greater responsibilities. In 1903, he became general foreman in charge of the working force, and upon the death of Richmond Viall, he became works superintendent, which position he held until he retired on December 31, 1921. Since that time he has been living at North Providence.

NEWS OF THE INDUSTRY

DETROIT POWER SCREWDRIVER CO., has removed its office and factory to 5365 Rohns Ave., Detroit, Mich.

FEDERAL PRESS CO., Elkhart, Ind., has appointed the Marshall & Huschart Machinery Co., 571 Washington Blvd., Chicago, Ill., exclusive representative for the company in the Chicago territory.

ALLIED DIE-CASTING CORPORATION, 43rd Ave. from 38th to 39th Sts., Long Island City, N. Y., has appointed L. H. Zintgraff, 907 Security Bldg., St. Louis, Mo., sales representative for the St. Louis territory.

FEDERAL PRESS CO., Elkhart, Ind., has appointed the Illinois National Supply Co., Indianapolis, Ind., exclusive representative for the sale of Federal openback, inclinable punch presses in the state of Indiana.

DIAMOND MACHINE CO., 11 Codding St., Providence, R. I., has appointed the Motch & Merryweather Machinery Co., 2842 W. Grand Blvd., Detroit, Mich., exclusive dealer in that area for the sale of Diamond hydraulic-drive face grinding and surface grinding machines.

LUMMUS CO., Boston, Mass., a new engineering and contracting firm having authorized capital stock of $10,000,000, has been organized to take over the business of the WALTER E. LUMMUS CO., Boston, Mass. The SUPERHEATER CO. and the BABCOCK & WILCOX CO. will hold substantial interests in the new firm.

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y., manufacturer of a complete line of sheet metal working machinery, has just opened a branch office in Detroit at 3-217 General Motors Bldg. Russell J. Caplin, who has been associated with the company for sixteen years, will have charge of the Detroit office.

ILLINOIS TESTING LABORATORIES, INC., 141 W. Austin Ave., Chicago, Ill., has appointed the James H. Knapp Co., 4920 Loma Vista Ave., Los Angeles, Calif., exclusive Pacific Coast distributor of the products of the company, including indicating pyrometers, resistance thermometers, and other electrical and magnetic measuring instruments.

LUDLUM STEEL CO., Watervliet, N. Y., is enlarging and modernizing its equipment for wire drawing, centerless grinding, and heat-treating. Rolling facilities for special shapes are being amplified to meet the demand for noncorrosive steel. The program will include considerable concentration of tool-steel production at the Dunkirk mill.

MCINTYRE ENGINEERING CO., 403 W. Baltimore St., Detroit, Mich., has been organized by P. J. McIntyre, who for the last seven years has been associated with the Wolverine Tube Co. as research and chief engineer. Mr. McIntyre will devote his time to consulting engineering practice, specializing on brass and copper tube products and production machinery for that class of work.

STEEL & TUBES, INC., Cleveland, Ohio, a subsidiary of the Republic Steel Corporation, announces that a new process for electrically welding high-carbon structural steel tubing has been developed. The new equipment for this work is located at the Elyria, Ohio, plant. The electrically welded tubing is said to possess greater strength and rigidity than tubing welded by former methods.

SOUTHWARK FOUNDRY & MACHINE CO., Philadelphia, Pa., announces that the major assets of the concern have been transferred to the BALDWIN-SOUTHWARK CORPORATION. All future communications should be addressed to the Baldwin-Southwark Corporation, Paschall Station Post Office, Philadelphia, Pa. There will be no change in the Southwark management, sales, or engineering personnel.

LINDE AIR PRODUCTS CO., 205 E. 42nd St., New York City, has been given charge (effective January 1) of the marketing of the products of the Union Carbide & Carbon Corporation that are used mainly for oxy-acetylene welding and cutting. It is now possible, therefore, for users to obtain Linde oxygen, Union-Carbide Prest-O-Lite, dissolved acetylene, and Oxweld, Prest-O-Weld, and Purox apparatus and supplies through this one company.

SIMONDS SAW & STEEL CO., Fitchburg, Mass., recently laid the cornerstone of the company's new factory, the first windowless factory to be built in the world. Thomas F. Howarth, vice-president, who has just celebrated his fiftieth anniversary as an employe and officer of the company, officiated at the ceremony. The business of which the Simonds Saw & Steel Co. is an outgrowth was founded in Fitchburg in 1832 by Abel Simonds, who manufactured steel edge tools. The new plant, which embodies practically every improvement known in factory construction, will be completed early in the summer.

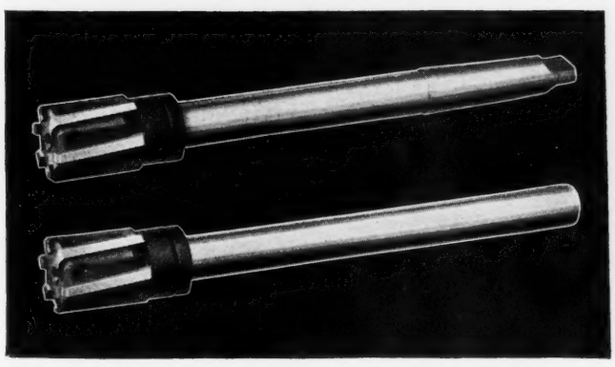
WETMORE

ADJUSTABLE REAMERS

The makers of each Wetmore Reamer take pride in its perfection. They are guided by the thought that each reamer, when completed, will be used by the kind of men who take pride in *their* work. That is one of the reasons why Wetmore, for many years, has been known throughout industry as "The Better Reamer".

Write for latest catalog of all types of Wetmore Machine and Cylinder Reamers and replacement blades.

WETMORE REAMER COMPANY
412 No. 27TH ST. MILWAUKEE, WISCONSIN



WETMORE
Type No. 11 HEAVY-DUTY REAMERS

With straight or taper arbor integral. Combines all the advantages of both solid and adjustable reamers. Left-hand angle blades prevent "digging in", chattering, and scoring by the reamer while backing out. The 1/8" projection of blades over end of reamer body allows chips to fall off ahead of reamer, so that they do not clog up along cutting edge of blades. Wide range of adjustment provides for wear and regrinding. Sizes range from 1" to 3", inclusive.

COMING EVENTS

FEBRUARY 16-20—Second National Western Metal Congress and Exposition to be held in the Civic Auditorium, San Francisco, Calif., under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

APRIL 13-18—Second National Industrial Equipment Exposition at the Public Auditorium in Cleveland, Ohio. Managing director, G. E. Pfisterer, 308 W. Washington St., Chicago, Ill.

APRIL 13-18—Eighth annual convention and exhibition of the American Oil Burner Association to be held in Philadelphia, Pa. Harry F. Tapp, executive secretary, 342 Madison Ave., New York City.

APRIL 20-23—Spring meeting of the American Society of Mechanical Engineers at Birmingham, Ala. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 4-9—Annual meeting of the American Foundrymen's Association, to be held at the Stevens Hotel, Chicago, Ill. In conjunction with the meeting, a limited exhibition of foundry equipment and supplies will be held. The office of the executive secretary is 222 W. Adams St., Chicago, Ill.

MAY 7-9—Fifteenth annual meeting of the American Gear Manufacturers Association at the Hotel Statler, Buffalo, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

MAY 27-29—Annual convention of the National Foreign Trade Council to be held at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York City.

JUNE 1-3—Regional meeting of the American Society of Mechanical Engineers at Hartford, Conn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 5-6—Annual convention of the National Association of Foremen at Dayton, Ohio. E. H. Tingley, secretary, U. B. Building, Dayton, Ohio.

JUNE 22-26—Annual meeting of the American Society for Testing Materials at the Stevens Hotel, Chicago, Ill. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

SEPTEMBER 21-25—Annual meeting of the American Society for Steel Treating and National Metal Exposition to be held at the Commonwealth Pier, Boston, Mass. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

CALENDARS RECEIVED

SIVYER STEEL CASTING CO., Milwaukee, Wis. Large wall calendar for 1931, containing three months on each sheet.

MOLINE TOOL CO., Moline, Ill., manufacturer of the "Hole Hog" line of drilling and boring machines, is distributing a calendar for the year 1931 to the trade.

NEW CATALOGUES AND CIRCULARS

ELECTRIC EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2213, containing data on safety circuits for electrical equipment.

LUBRICANTS. Acheson Oildag Co., 654 Madison Ave., New York City. Bulletin descriptive of the properties, uses, and advantages of colloidal graphite as a lubricant.

HOISTS. Union Mfg. Co., New Britain, Conn. Catalogue containing tables of specifications of Union spur geared hoists, army type trolley hoists, differential hoists, etc.

DRILL CHUCK. Union Mfg. Co., New Britain, Conn. Leaflet outlining the features of construction of New Britain drill chucks, and giving tables of dimensions and prices.

ELECTRIC EQUIPMENT. Roller-Smith Co., 233 Broadway, New York City. Supplement No. 3 to Bulletin 100, illustrating and describing the Type PD direct-current volt-ohmmeter.

SPEED REDUCERS. D. O. James Mfg. Co., 1120 W. Monroe St., Chicago, Ill. Catalogue 135, covering the line of small heavy-duty worm-gear speed reducers made by this concern.

ALUMINUM PRODUCTS. Aluminum Co. of America, Pittsburgh, Pa. Pamphlet descriptive of the electroplating of aluminum—a process that has been considered difficult and unsatisfactory in the past.

GRINDING MACHINES. Norton Co., Worcester, Mass. Bulletin illustrating and describing the Norton 44-inch car-wheel grinding machine. Complete specifications and a floor plan of the machine are included.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular No. 27 of a heat-treating series, dealing with the Hump method of hardening the tiny parts of Lufkin micrometers.

STOP-NUTS. Aga Co., Elizabeth, N. J. Bulletin containing technical data on the use of elastic stop-nuts intended for fastenings that require the nut to stay locked in any position along the threaded length of the bolt.

SELF-LOCKING SET-SCREWS. Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill. Circular illustrating and describing the new Shakeproof self-locking set-screw, which is so designed that it cannot shake loose.

MEEHANITE METAL. Dodge Mfg. Co., Ltd., Toronto, Canada. Circular describing the characteristics and physical properties of Meehanite metal—a metal of great strength and toughness which can be cast in any form.

ELECTRIC DRILLS, GRINDERS, POLISHERS, AND BUFFERS. Standard Electrical Tool Co., Cincinnati, Ohio. Circular illustrating and briefly describing various types of portable and floor-type electric drills, grinders, polishers, and buffers.

ELECTRIC MOTORS. Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin 207, illustrating and describing, in detail, Type T heavy-duty Reliance planer motors for reversing service. Illustrations showing various applications of these motors are included.

SPEED REDUCERS. W. A. Jones Foundry & Machine Co., 4401 W. Roosevelt Road, Chicago, Ill. Bulletin 49, covering the new line of worm-gear speed reducers made by this concern. These reducers are for small electric motor drives up to 7 horsepower capacity.

ELECTRIC MOTORS. Sterling Electric Motors, Inc., Telegraph Road and Atlantic Blvd., Los Angeles, Calif., is distributing a publication known as "Sterling Ideals," which is intended to give users information on the construction and application of Sterling motors.

STEEL FURNITURE AND SHOP EQUIPMENT. Angle Steel Stool Co., Plainwell, Mich. Catalogue M-S, containing data on the line of steel furniture and shop equipment made by this concern, including benches, cabinets, chairs, desks, pans, racks, stands, stools, tables, trucks, etc.

LATHES AND BUFFING AND GRINDING MACHINES. J. G. Blount Co., Everett, Mass. Catalogue 24, containing data on wet tool grinders of the belt- and motor-driven types; belt-driven buffers and grinders; motor-driven buffers and grinders; and belt- and motor-driven speed lathes.

SMALL TOOLS. Morse Twist Drill & Machine Co., New Bedford, Mass. Circular containing data relating to the part small tools play in keeping down the cost of machine tools by increasing their production. The circular illustrates various inspection operations on Morse cutters.

SMALL TOOLS. Brown & Sharpe Mfg. Co., Providence, R. I. Circular entitled "Fine Lines for Fine Measurements," illustrating various styles of Brown & Sharpe verniers, including universal bevel protractors, vernier calipers, thread-tool verniers, gear-tooth verniers, and vernier height and depth gages.

INDICATING AND CONTROLLING INSTRUMENTS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Bulletin illustrating the application of pyrometers and automatic control instruments to the regulation of temperature in thirty different makes of furnaces designed for the heat-treatment of metals.

WELDING EQUIPMENT. Hobart Brothers Co., Troy, Ohio. Circular entitled "The Open Door to Everlasting Economies," illustrating and describing Hobart "Constant Arc" welding machines. Bulletin E-9, outlining the savings in material, labor, overhead, and selling costs effected by the use of "Constant Arc" welding equipment.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circulars GEA 132, 925B, 1011B, 1080A, 1145A, 1266A, 1276, and 1336, illustrating and describing, respectively, phase protective panels; oil circuit-breakers; steam turbines; mechanical-drive turbines; photoelectric relays; fractional-horsepower motors; and general-purpose squirrel-cage induction motors.

PRECISION LATHES. South Bend Lathe Works, 719 E. Madison St., South Bend, Ind. South Bend Handbook No. 44 for the mechanic, describing the features of construction of the New Model South Bend back-geared screw-cutting and precision lathes. The pamphlet shows a variety of jobs for which these lathes are adapted. Booklet 3-C, containing a classified list of some of the plants using New Model South Bend lathes.

WEIGHING SCALES. Howe Scale Co., Rutland, Vt. Catalogue entitled "There is Nothing Like the Weightograph," illustrating and describing an automatic indicating instrument that can be attached to any type of beam-operated scale, either small or large, and when so attached provides all the advantages of an automatic scale without disturbing the scale or discarding anything but one beam stand, which is replaced by the Weightograph.

PRECISION MEASURING EQUIPMENT AND MACHINES. Societe Genevoise d'Instruments de Physique, Geneva, Switzerland (United States Agent, R. Y. Ferner Co., Investment Bldg., Washington, D. C.). Circular 527, illustrating and describing a new model Swiss high-speed precision borer, designed for handling small work, such us laying out, drilling, and boring holes in dies and instrument parts. Circular 518, descriptive of the Sip micro-indicator for testing a wide variety of parts.

METAL-WORKING TOOLS AND MACHINERY. Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill. General catalogue No. 30 containing 158 pages, covering practically every type of tool and portable machine used in the metal-working field, including electric and pneumatic tools, hoisting equipment, small tools, shop furniture, bench lathes, drills, milling machines, presses, etc., vises, chucks, and lathe tools, sheet-metal working machinery, and equipment for the structural, boiler, or blacksmith shop.